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ARTICLE 30

PRECAUTIONS DURING BUILDING OPERATIONS

SECTION 3000.0 GENERAL

3000.1 Scope: The provisions of this article shall apply to all construction operations in connection with the erection, alteration, repair, removal or demolition of buildings and structures.

3000.2 Other laws: Nothing herein contained shall be construed to nullify any rules, regulations or statutes of state agencies governing the protection of the public or workers from health or other hazards involved in manufacturing, mining and other processes and operations which generate toxic gases, dust or other elements dangerous to the respiratory system, eyesight or health.

3000.2.1 Other regulations: In addition, the following regulations also shall apply when not covered by this code: *Rules and Regulations in Construction Operations* (441 CMR 10.00); and *Keeping, Storage, Use, Manufacture, Sale, Handling, Transportation of Explosives* (527 CMR 13.00) listed in Appendix G.

3000.3 Combustible and explosive hazards: The provisions of this code which apply to the storage, use or transportation of explosives, highly flammable and combustible substances, gases and chemicals shall be construed as supplemental to the requirements of the federal laws, the regulations of the Department of Transportation (DOT) and the rules and regulations of the jurisdiction.

SECTION 3001.0 PLANS, SPECIFICATIONS AND SPECIAL PERMITS

3001.1 Temporary construction: Before any construction operation is started, plans and specifications shall be filed with the building official showing the design and construction of all sidewalk sheds, truck runways, trestles, foot bridges, guard fences and other similar devices required in the operation. Approval of the building official shall be secured before the commencement of any work.

3001.2 Special permits: All special licenses and permits for the storage of materials on sidewalks and highways, for the use of water or other public facilities and for the

storage and handling of explosives shall be secured from the administrative authorities having jurisdiction.

3001.3 Temporary encroachments: Subject to approval, sidewalk sheds, underpinning and other temporary protective guards and devices shall project beyond the interior and street lot lines where required to insure the safety of the adjoining property and the public. When necessary, the consent of the adjoining property owner shall be obtained.

SECTION 3002.0 TESTS

3002.1 Loading: It shall be unlawful to load any structure, temporary support, scaffolding, sidewalk bridge or sidewalk shed or any other device or construction equipment during the construction or demolition of any building or structure in excess of its safe working capacity as provided in Article 11 for allowable loads and working stresses.

3002.2 Unsafe equipment: Whenever any doubt arises as to the structural quality or strength of scaffolding plank or other construction equipment, such material shall be replaced, or the building official shall require a strength test to two and one-half times the superimposed live load to which the material or structural member is to be subjected. The member shall sustain the test load without failure.

SECTION 3003.0 INSPECTION

3003.1 Unsafe conditions: When inspection of any construction operation reveals that any unsafe or illegal conditions exist, the building official shall notify the owner and direct the owner to take the necessary remedial measures to remove the hazard or violation.

3003.2 Failure to comply with orders: Unless the owner so notified proceeds to comply with the orders of the building official within 24 hours, the building official shall have full power to correct the unsafe conditions as provided in Sections 121.0 and 123.0. All expenses incurred in the correction of such unsafe conditions shall become a lien on the property.

3003.3 Unsafe construction equipment: When the strength and adequacy of any scaffold or other device or construction equipment is in doubt, or when any complaint is made, the building official shall inspect such equipment and shall prohibit its use until tested as required in Section 3002.2 or until all danger is removed.

SECTION 3004.0 MAINTENANCE

3004.1 General: All construction equipment and safeguards shall be constructed, installed and maintained in a substantial manner and shall be so operated as to insure protection to the workers engaged thereon and to the general public. It shall be unlawful to remove or render inoperative any structural, fire protection or sanitary safeguard or device herein required except when necessary for the actual installation and prosecution of the work.

SECTION 3005.0 EXISTING BUILDINGS

3005.1 Protection: All existing and adjoining public and private property shall be protected from damage incidental to construction operations.

3005.2 Chimney, soil and vent stacks: Whenever a new building or structure is erected to greater or lesser heights than an adjoining building, the construction and extension of new or existing chimneys shall conform to the provisions of the BOCA National Mechanical Code listed in Appendix A, and the construction and extension of soil and vent stacks and the location of window openings shall comply with the provisions of Section 2805.4.

3005.3 Adjoining walls: The owner of the new or altered structure shall preserve all adjoining independent and party walls from damage as provided herein. The owner shall underpin where necessary and support the adjoining building or structure by proper foundations to comply with Section 3007.0.

3005.3.1 Maintenance: In case an existing party wall is intended to be used by the person who causes an excavation to be made, and such party wall is in good condition and sufficient for the use of both the existing and proposed building, such person shall preserve the party wall from injury and support it by proper foundations at his own expense, so that it shall be and remain as safe and useful as it was before the excavation was commenced. During the demolition, the party wall shall be maintained weatherproof and structurally safe by adequate bracing until such time as the permanent structural supports shall have been provided.

3005.3.2 Beam holes: When a structure involving a party wall is being demolished, the owner of the demolished structure shall, at his own expense, bend over all wall anchors at the beam ends of the standing wall and shall brick up wall open beam holes and otherwise maintain the safety and usefulness of the all.

3005.3.3 Party wall exits: A party wall balcony or horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved.

3005.4 Adjoining roofs: When a new building or demolition of an existing building is being conducted at a greater height, the roof, roof outlets and roof structures of adjoining buildings shall be protected against damage with adequate safeguards by the person doing the work.

SECTION 3006.0 PROTECTION OF PUBLIC AND WORKERS

3006.1 General: Whenever a building or structure is erected, altered, repaired, removed or demolished, the operation shall be conducted in a safe manner and suitable protection for the general public and workers employed thereon shall be provided.

3006.2 Fences: Every construction operation located 5 feet or less from the street lot line shall be enclosed with a fence not less than 8 feet high to prevent entry of unauthorized persons. When located more than 5 feet from the street lot line, a fence or other barrier shall be erected when required by the building official. All fences shall be of adequate strength to resist wind pressure as specified in Section 1111.0.

3006.3 Sidewalk bridge: Whenever the ground is excavated under the sidewalk, a sidewalk bridge shall be constructed at least 4 feet wide, or a protected walkway of equal width shall be erected in the street, provided the required permit from such walkway is obtained from the administrative authority.

3006.4 Sidewalk shed: Sidewalk sheds shall be provided in accordance with Sections 3006.4.1 through 3006.4.4.

3006.4.1 Within 10 feet of street lot line: When any building or part thereof which is located within 10 feet of the street lot line is to be erected or raised to exceed 40 feet in height, or whenever a building more than 40 feet in height within 10 feet of the street lot line is to be demolished, a sidewalk shed shall be erected and maintained for the full length of the building on all street fronts for the entire time that work is performed on the exterior of the building.

3006.4.2 Within 20 feet of street lot line: When the building being demolished or erected is located within 20 feet of the street lot line and is more than 40 feet in height, exterior flare fans or catch platforms shall be erected at vertical intervals of not more than two stories.

3006.4.3 Buildings higher than six stories: When the building being demolished or erected is more than six stories or 70 feet in height, unless set back from the street lot line a distance more than one-half its height, a sidewalk shed shall be provided.

3006.4.4 Walkway: An adequately lighted walkway at least 4 feet wide and 8 feet high in the clear shall be maintained under all sidewalk sheds for pedestrians. Where ramps are required, they shall conform to the provisions of this article and Section 815.0.

3006.5 Thrust-out platforms: Thrust-out platforms or other substitute protection in lieu of sidewalk sheds shall not be used unless approved and deemed adequate to insure the public safety. Thrust-out platforms shall not be used for the storage of materials.

3006.6 Watchman: Whenever a building is being demolished, erected or altered, a watchman shall be employed to warn the general public when intermittent hazardous operations are conducted across the sidewalk or walkway.

SECTION 3007.0 DEMOLITION AND EXCAVATION

3007.1 Notice of intent: The person intending to cause a demolition or an excavation shall deliver written notice of such intent to the owner of each potentially affected adjoining lot, building or structure at least one week prior to the commencement of work. The notice shall request license to enter the potentially affected lot, building or structure prior to the commencement of work and at reasonable intervals during its prosecution to inspect and preserve it from any damage which might result from the intended work.

3007.1.2 Temporary support: Until permanent support has been provided, all excavations shall be safeguarded and protected by the person causing the excavations to be made to avoid all danger to life or limb. Where necessary, such excavations shall be retained by temporary retaining walls, sheet-piling and bracing or other approved method to support the adjoining earth. (See 441 CMR 10.00).

3007.2 Protection of adjoining property: If afforded the necessary license to enter the adjoining lot, building or structure, the person causing the demolition or excavation to be made shall at all times and at his own expense preserve and protect it from damage or injury. If the necessary license is not afforded, it shall be the duty of the owner of the adjoining lot, building or structure to make safe his own property, for the prosecution of which he shall be granted the necessary license to enter the premises of the demolition or excavation.

3007.2.1 Removal of debris: All waste materials shall be removed in a manner which prevents injury or damage to persons, adjoining properties and public rights of way.

3007.3 Notice to the building official: If the person causing a demolition or excavation to be made is not afforded license to enter an adjoining structure, he

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shall immediately notify in writing both the building official and the owner of the adjoining property that the responsibility of providing support to the adjoining lot, building or structure has become the exclusive responsibility of the owner of the adjoining property.

SECTION 3008.0 REGULATION OF LOTS

3008.1 Grading of lot: When a building or structure has been demolished or removed and building operations have not been projected or approved, the vacant lot shall be filled, graded and maintained in conformity to the established street grades at curb level. The lot shall be maintained free from the accumulation of rubbish and all other unsafe or hazardous conditions which endanger the life or health of the public. Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

3008.2 Utility connections: All service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the authority having jurisdiction and Section 105.1.

SECTION 3009.0 RETAINING WALLS AND PARTITION FENCES

3009.1 General: When the adjoining grade is not higher than the legal level, the person causing an excavation to be made shall erect, when necessary, a retaining wall at his own expense and on his own land. Such wall shall be built to a height sufficient to retain the adjoining earth, shall be properly coped as required in Section 1223.0 and shall be provided with a guardrail or fence not less than 42 inches in height.

SECTION 3010.0 STORAGE OF MATERIALS

3010.1 General: All materials and equipment required in construction operations shall be stored and placed so as not to endanger the public, the workers or adjoining property.

3010.2 Design capacity: Materials or equipment stored within the building, or on sidewalks, sheds or scaffolds shall be placed so as not to overload any part of the construction beyond its design capacity, nor interfere with the safe prosecution of the work.

3010.3 Special loading: Unless the construction is designed for special loading, materials stored on sidewalk sheds and scaffolds shall not exceed a one-day supply. All materials shall be piled in an orderly manner and height, to permit removal of individual pieces without endangering the stability of the pile.

3010.4 Pedestrian walkways: Materials or equipment shall not be stored on the street without a permit issued by the administrative official having jurisdiction. When so stored, they shall not unduly interfere with vehicular traffic or the orderly travel of pedestrians on the highway or street. The piles shall be arranged to maintain a safe walkway not less than 4 feet wide, unobstructed for its full length, and adequately lighted at night and at all necessary times for the use of the public.

3010.5 Obstructions: Material and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, utility boxes, catch basins or manholes, nor shall they be located within 20 feet of a street intersection, or so placed as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

SECTION 3011.0 REMOVAL OF WASTE MATERIAL

3011.1 General: Material shall not be dropped by gravity or thrown outside the exterior walls of a building during demolition or erection. Wood or metal chutes shall be provided for this purpose and any material which in its removal will cause an excessive amount of dust shall be wet down to prevent the creation of a nuisance.

SECTION 3012.0 PROTECTION OF ADJOINING PROPERTY

3012.1 General: Adjoining property shall be completely protected from any damage incidental to the building operation when the owner of the adjoining property permits free access to the building at all reasonable times to provide the necessary safeguards in accordance with Section 3007.0.

SECTION 3013.0 PROTECTION OF FLOOR AND WALL OPENINGS

3013.1 Noncombustible floor construction: The arches, slabs or structural floor fillings of buildings of Types 1 and 2 construction shall be installed as the building progresses.

3013.2 Combustible floor construction: In Types 3, 4 and 5 construction when double flooring is used, the underfloor shall be laid on each story as the building progresses; and when double floors are not used, the floors shall be planked over two stories below the level where work is being performed.

3013.3 Steel structural frames: In steel construction, the entire tier of iron or steel beams upon which the structural work is in progress shall be planked over, with the exception of necessary hoistways and permanent openings. steel work shall not advance more than six floors ahead of the permanent floor construction.

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3013.4 Guardrails: All floor and wall openings shall be protected with substantial guardrails and toe boards in accordance with ANSI A12.1 listed in Appendix A.

SECTION 3014.0 SCAFFOLDS

3014.1 Load capacity: Scaffolds and their components shall be capable of supporting without failure at least four times the maximum intended load. All platforms and supporting elements of scaffolds shall be designed and constructed to support uniform minimum live loads in pounds per square foot of the platform area in accordance with the classifications described in Table 3014.

3014.2 Erection: Built-up, swinging and suspended scaffolds shall be erected by competent workers only.

3014.3 Scaffolding: Scaffolding shall be constructed in accordance with Sections 3014.3.1 and 3014.3.2.

3014.3.1 All buildings: All scaffolding exceeding 60 feet or seven stories in height used in construction operations involving the erection, alteration or maintenance of buildings, shall be constructed of noncombustible or fire-retardant materials complying with the provisions of Section 903.0.

Table 3014
SCAFFOLD LOAD CAPACITY

Classification	Service type	Load (pounds per s.f.)
Light Duty	Carpenters	25
	Stone setters (no stone on scaffold)	25
	Miscellaneous (no material on scaffold)	25
Medium duty	Bricklayers	50
	Stucco	50
	Lathers and plasterers	50
Heavy duty	Stone masons	75

3014.3.2 Use Group I: All scaffolding used in construction operations involving the repair or partial demolition during occupancy of buildings of Use Groups I-2 and I-3 shall be constructed of noncombustible or fire-retardant materials complying with the provisions of Section 903.0.

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SECTION 3015.0 HOISTS

3015.1 Equipment for handling and hoisting material: Equipment for handling and hoisting materials shall be in accordance with **Article 17 of the Rules and Regulations for the Prevention of Accidents in Construction Operations (441 CMR 10.00)**.

3015.2 Passengers prohibited: Persons shall not be permitted to ride a material hoist. Temporary elevators shall be installed when necessary to transport workers as provided in Article 26.

3015.3 Guarding of cables: All hoisting cables and signal cords shall be guarded whenever they pass through or cross working spaces to prevent injury to persons.

3015.4 Rigger's license: All persons engaged in the erection of derricks and other hoisting apparatus shall secure a license or certificate of fitness for the performance of such work from the authorized administrative official.

SECTION 3016.0 STAIRWAYS AND LADDERS

3016.1 Temporary stairways: When a building has been constructed to a greater height than 50 feet or four stories, or when an existing building exceeding 50 feet in height is altered, at least one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected as the construction progresses.

3016.2 Ladders: Temporary ladders, when permitted for access to floors before stairways are installed, or which are designed for other working purposes, shall extend at least 42 inches above the floor level which they serve.

SECTION 3017.0 LIGHTING

3017.1 General: All stairways and parts of buildings under demolition, erection or repair shall be adequately lighted while persons are engaged at work, to comply with the provisions of Sections 824.0 and 2701.2.5.

SECTION 3018.0 FIRE HAZARDS

3018.1 General: The provisions of this code and of the fire prevention code listed in Appendix A shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

3018.2 Temporary heating: Whenever salamanders or other heating devices are used for temporary heating, all regulations as to maximum temperature, distance from combustible materials, spark arrestors, removal of noxious gases, and other requirements prescribed by the building official shall be fully observed. When the

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source of temporary heat consists of salamanders or other open-flame devices, temporary canvas enclosures shall comply with Section 904.0

3018.3 Steam boilers: All temporary or permanent high-pressure steam boilers shall be operated, or be in charge of engineers or firemen licensed in accordance with the provisions of Inspection of Boilers, Air Tanks, etc.; Licenses of Hoisting Machinery, Chapter 146 of the Massachusetts General Laws Annotated, as amended, and as listed under Boiler Regulations in Appendix G. When such boilers are located within a building or within ten (10) feet thereof, all such boilers shall be enclosed with approved noncombustible construction.

3018.4 Storage of flammables: Storage of gasoline for hoists, oils, paints and other highly flammable materials shall be permitted only as specified in Article 6 and when stored in approved safety containers. The storage of larger quantities shall not be approved unless stored in separate compartments or enclosures of approved noncombustible construction.

3018.5 Flame cutting and welding: The use of oxyacetylene torches for cutting or welding shall be permitted only in accordance with ANSI Z49.1 listed in Appendix A.

3018.6 Concrete forms: Combustible materials shall not be stored on any floor of a building under construction until all combustible concrete forms are removed from the tier immediately above.

3018.7 Fire extinguishers: Fire extinguishers shall be provided as required by Section 1021.0.

3018.8 Standpipes and fire lines: Where standpipes are provided as a permanent part of the building, they shall be installed and made ready for instant use by the fire department as the structure progresses in accordance with the provisions of Section 1013.0. Free access from the street to such standpipes shall be maintained at all times. Materials shall not be stored within 5 feet of any fire hydrant or in the roadway between such hydrant and the center line of the street.

3018.9 Housekeeping: Rubbish and trash shall not be allowed to accumulate on the site and shall be removed as fast as conditions warrant. Combustible rubbish shall be removed daily, and shall not be disposed of by burning on the premises or in the immediate vicinity. The entire premises and area adjoining and around the operation shall be kept in a safe and sanitary condition and free of accumulation of trash, rubbish, nuts, bolts, small tools and other equipment.

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SECTION 3019.0 HEALTH HAZARDS

3019.1 General: Every construction or maintenance operation which results in the diffusion of dust, stone and other small particles, toxic gases or other harmful substances in quantities hazardous to health shall be safeguarded by means of local ventilation or other protective devices to insure the safety of the public as required by the regulations of the administrative official.

3019.2 Removal of dust: Dust, sand blasts or other harmful agents, when employed or occurring in construction operations, shall be disposed of at or near the point of origin to prevent their diffusion over adjoining premises or streets.

3019.3 Protective equipment: Facilities shall be provided in approved closed containers for housing the necessary vision, respiratory and protective equipment required in welding operations, and in accordance with the regulations of the administrative official.

SECTION 3020.0 WELDING SAFETY PRECAUTIONS

3020.1 Welding enclosures: All welding and flame-cutting operations shall be performed in protected areas with full consideration of safety and fire hazards. Such closed spaces shall be properly ventilated while welding or cutting is being done. Suitable protection against the rays of the electric arc shall be maintained by the contractor where arc welding operations might be viewed within harmful range by persons other than the welding operators and inspectors.

3020.2 Flammable materials: Proper precautions shall be taken to avoid all risk of fire or explosion, and flammable or explosive materials shall not be stored in the vicinity of welding or cutting operations.

SECTION 3021.0 SANITATION

3021.1 General: Every building in the course of demolition, erection or repair shall be provided with toilet and drinking water facilities which shall be constructed and installed in accordance with the **Massachusetts State Plumbing Code (248 CMR 2.00)** listed in Appendix G.

SECTION 3022.0 DISPUTES

3022.1 General: The building official, when requested by any person, aggrieved or otherwise, shall serve a written notice on any owner, tenant and their agents who fail to conform to the requirements of this article directing such person to take the necessary remedial action. If the person whose duty it is to protect his own or adjoining property under those provisions fails to proceed to fully comply with such

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notice within three days of receipt thereof, or within a reasonable time thereafter as determined by the building official, the building official is authorized to cause the necessary work to be done when the health, safety and general welfare of the public are involved. The cost of such work shall become a lien against the property of the offending owner, and the legal authority of the jurisdiction shall institute appropriate action for its recovery.

ARTICLE 31

ENERGY CONSERVATION

(This Article is entirely unique to Massachusetts)

SECTION 3100.0 GENERAL

3100.1 Scope: This article sets forth requirements for the effective use of energy in structures.

SECTION 3101.0 ADMINISTRATIVE

3101.1 Compliance: Buildings shall be deemed to be in compliance with this article when built to the provisions of the following:

1. component design (Section 3108.0-3114.0); or
2. building design by systems analysis (Section 3115.0); or
3. buildings utilizing nondepletable energy sources (Section 3116.0).

3101.2 Other regulations: This article is not intended to abridge any safety or health provisions required under any other applicable codes or ordinances.

3101.3 Existing buildings: Nothing in this article shall require the removal, alteration, or abandonment, or prevent the continuance of the use and occupancy of, a lawfully existing building, unless provided otherwise specifically by this article.

3101.4 Exempt buildings: The following buildings are exempt from the provisions of this article, with the exception of Section 3113.0 dealing with lighting requirements:

1. Buildings and structures or portions thereof whose peak design rate of energy usage is less than one (1) watt per square foot or three and four tenths (3.4) Btu/h per square foot of floor area for all purposes;
2. Buildings which are neither heated nor cooled;
3. Greenhouses that are free-standing, or attached to a building and separated by a wall having the same thermal value as an exterior wall, and provided with a separate temperature control system;
4. Buildings with less than one hundred (100) square feet of gross floor area.

SECTION 3102.0 EXISTING BUILDINGS

3102.1 Additions to existing buildings: Additions to existing buildings or structures shall be made without making the entire building or structure comply. The new construction shall conform to the provisions of this article as they relate to the addition only.

3102.2 Alterations to existing buildings: See Article 32.

SECTION 3103.0 PLANS AND SPECIFICATIONS

3103.1 Scope: This section applies to all buildings.

3103.2 General: Plans, specifications and necessary computations shall be submitted to indicate conformance with this section and other applicable sections of the code.

3103.3 Details: The data submitted shall show all pertinent information and features to be incorporated into the building, including but not limited to: the exterior envelope component materials; the R values of the respective elements; the U values of the overall assembly; calculations of overall Uo of the walls, roof/ceiling, and floors; the size and type of apparatus and equipment; controls; lighting requirements; and other pertinent data to indicate conformance to this article. Where required by the Board of Building Regulations and Standards or the local enforcement official, such data shall be submitted on forms specified.

3103.4 Calculation procedures: Calculation procedures shall be in accordance with data in the ASHRAE Handbook, 1985 Fundamentals Volume.

SECTION 3104.0 MATERIALS AND EQUIPMENT

3104.1 Identification: Where practicable, all materials and equipment referenced in Section 3103.2 shall be marked in order to show compliance with this article.

3104.2 Maintenance information: Service systems which require preventive maintenance to maintain efficient operation shall be furnished with complete necessary maintenance information. Required routine maintenance actions, as specified by the manufacturer, shall be stated clearly and incorporated on a readily accessible label on the equipment. Such label may be limited to identifying, by title or publication number, the operation and maintenance manual for that particular model and type of product.

SECTION 3105.0 DESIGN CONDITIONS

3105.1 Scope: This section applies to all buildings.

3105.2 General: The criteria of this section establish the minimum requirements for the thermal design of the exterior envelope of buildings and for HVAC systems and equipment.

3105.3 Thermal performance: A building that is designed to be both heated and cooled shall meet the more stringent of the heating or cooling requirements as provided in this article when requirements differ.

3105.4 Design parameters: The design parameters listed in Tables 3105.1 and 3105.2 shall be used for calculations required under this article.

3105.4.1 Indoor design temperature: Indoor design temperature shall be seventy-two (72) degrees F for heating and seventy-eight (78) degrees F for cooling.

3105.4.2 Design humidity: Indoor design relative humidity for heating shall not exceed thirty (30) per cent. For cooling, the actual design relative humidity within the comfort envelope as defined in ASHRAE Standard 55-81 listed in Appendix A shall be selected for minimum total HVAC system energy use in accordance with accepted practice.

3105.5 Ventilation: Ventilation air shall conform to the requirements specified in the mechanical code listed in Appendix A.

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Table 3105.1
DESIGN TEMPERATURES
HEATING DEGREE DAYS BASE 65
HDD₆₅

Outside Ambient				
Location	Heating Degrees (°F) Winter	Cooling Degrees (°F) Dry Bulb Summer	Cooling Degrees (°F) Wet Bulb Summer	Heating Degree Days Base 65
Boston	9	88	74	5634
Clinton	2	87	73	6517
Fall River	9	84	73	5774
Framingham	6	86	73	6144
Gloucester	5	86	74	-
Greenfield	-2	85	73	-
Lawrence	0	87	74	6195
Lowell	1	88	74	6056
New Bedford	9	82	73	5395
Pittsfield	-3	84	72	7578
Springfield	0	87	73	5844
Taunton	9	86	74	6184
Worcester	4	84	72	6989

TABLE 3105.2
HEATING DEGREE DAYS BASE 50
HDD₅₀

Location	Heating Degree Days Base 50
Amherst	3171
Birch Hill Dam	3733
Blue Hill	2926
Boston	2383
Chatham	2377
Chestnut Hill	2658
Clinton	3107
East Wareham	2780
Edgartown	2499
Fitchburg	3156
Framingham	2855
Haverhill	2734
Hyannis	2478
Knightville Dam	3693
Lawrence	2867
Middleton	2676
Nantucket	2347
New Bedford	2107
Plymouth	2619
Rochester	2807
Rockport	2726
Springfield	2706
Stockbridge	3551
Taunton	2800
Tulley Lake	3786
Worcester	3364

SECTION 3106.0 BUILDING INSULATION SPECIFICATIONS

3106.1 Scope: This section applies to all buildings.

3106.2 General: Insulating materials must conform to the Federal Specifications (F.S.), the American Society for Testing Materials (ASTM) Test Standards, or the Code of Federal Regulations (CFR) as listed in Table 3106.

Table 3106
INSULATION MATERIALS STANDARDS

Material	Standard
Mineral Fiber blanket/batt loose-fill	ASTM C665-78 ASTM C-764-73
Mineral Cellular perlite vermiculite perlite board cellular glass block	ASTM C549-81 ASTM C516-80 ASTM C728-82 ASTM C552-79
Organic Fiber cellulose fiber board cellulose loose fill	ASTM C208-82 16 CFR Part 1209
Organic Cellular polystyrene board urethane board flexible unicellular polyurethane or polyiso- cyanurate with foil face polyurethane or polyiso- cyanurate with felt face	ASTM C578-83 ASTM C591-69 ASTM C534-70 F.S. HH-1-1972-1 F.S. HH-1-1972-2

3106.3 Moisture control: The design of buildings for energy conservation shall not create conditions of accelerated deterioration from moisture condensation (additionally, see Article 5 for attic and under-floor space ventilation).

3106.4 Installation

3106.4.1 Recessed light fixtures: Only IC labeled recessed lights allowing direct contact with insulating materials may be used in areas separating conditioned and unconditioned spaces.

3106.4.2 High heat sources: A clearance of three (3) inches from any high heat source, including but not limited to chimneys, flues and vents, shall be maintained for combustible insulating materials.

3106.4.3 Urea formaldehyde foams: Urea formaldehyde foams shall not be used in any building.

3106.4.4 Walls: Batt/blanket insulation with a vapor barrier attached shall be stapled to the sides or faces of wall studs at intervals of eight (8) inches on center vertically.

Where batt/blanket insulation is of a "friction fit" design and a poly vapor barrier is employed, the vapor barrier shall be affixed to the interior face of the wall studs in accordance with the insulation manufacturer's recommendations.

3106.4.5 Cavities: All cavities between rough framing and door and window heads, jambs, and sills shall be filled with insulation and covered with a vapor barrier meeting the criteria of 3107.

3106.4.6.1 Low Rise Residential: Perimeter insulation for slab on grade construction in buildings of Use Group R of three stories or less shall be installed so that the concrete to concrete contact between the foundation wall and the floor slab is broken and the insulation extends downward the thickness of the slab and then extends four (4) feet vertically down from, or four (4) feet horizontally beneath, the floor slab. Perimeter insulation may be installed in alternative locations if installed in a manner to thermally isolate the floor from the exterior.

3106.4.6.2 Perimeter Insulation: Perimeter Insulation for slab on grade construction in buildings of Use Group R of more than three stories or in buildings of other Use Groups shall be installed in a manner consistent with that specified in Section 3106.4.6.1, except that alternate locations and dimensions may be permitted by the provisions of Section 3114.

3106.4.7 Foundation wall insulation:

1. For interior foundation wall insulation, the entire gross wall area extending from the top of the band joist to the floor shall be insulated in accordance with Table 3109.1.
2. For exterior foundation wall insulation, the insulation shall extend from the top of the foundation to a minimum of eight feet below grade or to foundation footing, whichever is less. All exterior basement and foundation wall insulation shall be suitably protected so as to prevent deterioration caused by ultra-violet light or insect damage in accordance with manufacturer's instructions.

3106.5 Fire safety relating to insulation: See Sections 928 and 2002.

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3106.6: Labeling

3106.6.1 Batt and blanket and rigid board: Insulation of this type shall be labeled according to type, manufacturer or distributor, R value of the insulation at the labeled thickness, and material specification as listed in Table 3106.

3106.6.2 Blown, poured, or sprayed on types: Insulation of these types shall be labeled according to type, manufacturer, recommended insulation density, thickness and R value, fire safety requirements and material specifications as listed in Table 3106.

SECTION 3107.0 AIR INFILTRATION AND MOISTURE CONTROL

3107.1 This section applies to all buildings.

3107.2 Vapor barriers: A vapor barrier of one point zero (1.0) perm or less shall be installed on the winter warm side of walls, ceilings and floors enclosing a conditioned space.

Exception: Vapor barriers may be eliminated with adequate ventilation as defined in Article 7 (See Section 709).

3107.3 Taping: All tears in the vapor barrier shall be taped or sealed.

3107.4 Air leakage for all buildings

1. The requirements of this section shall apply to those locations separating outdoor ambient conditions from interior spaces that are heated or mechanically cooled and are not applicable to the separation of interior conditioned spaces from each other.
2. The following openings in the exterior building envelope shall be caulked, gasketed, weatherstripped, foamed or otherwise sealed to limit infiltration:
 - a. Around window and door frames, between the unit and the rough framing;
 - b. Between all exterior wall soleplates and the structural floor, using two rows of caulking or alternate approved procedure;
 - c. Over all framing joints where floors over conditioned spaces intersect exterior walls, using a water vapor permeable infiltration barrier or alternate approved technique;
 - d. Around openings for plumbing, electricity, telephone and gas lines in walls, ceilings and floors;

- e. At openings in the ceiling, such as where the ceiling panels meet interior and exterior walls, at exposed beam and masonry fireplaces;
 - f. At the mudsill, in addition to normal sill sealer in conditioned basements and conditioned crawlspaces; and,
 - g. At all other openings in the exterior building envelope.
3. Electrical outlet plate gaskets shall be installed on all receptacle, switch, or other electrical boxes in exterior and interior walls.
 4. Heating ducts shall be sealed at all joints and corners as specified in 3110.9.
 5. Interior openings between conditioned and non-conditioned space shall be sealed using sealant, closed-cell gasket material, permanent tape, or another method that limits infiltration.

3107.5 Air leakage requirements for fenestration and doors

3107.5.1 Windows shall have an air leakage rate of 0.34 cfm per foot of operable sash crack in accordance with the following standards:

ANSI/AANA 101-85, Aluminum Prime Windows,

ASTM D 4099-83, Specifications for Polyvinylchloride (PCV)
Prime Windows, or

ANSI/NWMA I.S. 2-80, Wood Window Units (Improved Performance
Rating Only).

3107.5.2 Sliding Doors shall meet one of the following standards for air leakage:

ANSI/AANA 101-85, Aluminum Sliding Glass Doors, or

NWMA I.S. 3-83, Wood Sliding Patio Doors.

3107.5.3 Commercial entrance swinging or revolving doors shall limit air leakage to a rate not to exceed 1.2 cfm per square foot of door area, at standard test conditions.

3107.5.4 Residential swinging doors shall limit air leakage to a rate not to exceed 0.5 cfm per square foot of door area, at standard test conditions.

3107.5.5 Spaces that have regular high volume traffic through the building envelopes such as retail store entrances and loading bays, shall be designed accounting for the steady state air transfer between conditioned and unconditioned or exterior space.

SECTION 3108.0 COMPONENT DESIGN

3108.1 Scope: All low rise residential buildings that are heated or mechanically cooled shall be constructed so as to provide the required thermal performance of the various components listed in Sections 3108.0 through 3112.0, and to provide the lighting switching requirements of Section 3113.2.2.1.

All commercial and high rise residential buildings that are mechanically heated and cooled shall be constructed so as to provide the required thermal and lighting system performance of the various components listed in Sections 3108.0, and 3110.0 through 3114.0.

3108.2 Thermal Performance: Information on thermal properties, performance of building envelope sections and components, and heat transfer shall be obtained from laboratory or field test measurements, or when information is not available from these sources, then such information may be obtained from the ASHRAE Handbook, 1985 Fundamentals.

When laboratory or field test measurements are used, they shall be conducted in accordance with ASTM standards:

1. C-177-76, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate,
2. C-518-76, Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter,
3. C-236-80, Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box, or
4. C-976-82, Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box.

To determine thermal conductance through window assemblies the following ASTM or American Architectural Manufacturers Association (AAMA) standards shall be used.

1. AAMA 1503.1-1980, Test Method of Thermal Transmittance of Windows, Doors and Glazed Wall Sections,

2. ASTM C-236-80, Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of Guarded Hot Box, or
3. ASTM C-976-82, Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box.

When using any of the three test procedures above, a fifteen mile per hour wind shall be applied perpendicular to the glazing.

3108.3 Gross wall area: For the purposes of this, Article 31, the gross area of exterior walls consists of all opaque wall areas, including foundation walls, areas between floor spandrels, peripheral edges of floors, window areas including sash, and door areas, where such surfaces enclose a heated or mechanically cooled space including interstitial areas between two (2) such spaces, but excluding vents, grills and pipes.

3108.4 Roof assembly: For the purpose of this article, a roof assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thereby creating a building transmission heat loss or gain, where such assembly encloses a heated or mechanically cooled space.

3108.4.1 Gross roof area: The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights, exposed to the heated or mechanically cooled space.

3108.4.2 Ceiling plenums: Where air ceiling plenums are employed, the roof/ceiling assembly shall:

1. for thermal transmittance purposes not include the ceiling proper nor the plenum space as part of the assembly; and
2. for gross area purposes be based upon the interior face of the upper plenum surface.

3108.5 Swimming pools: All pool enclosures shall be designed in accordance with the 1982 edition of the ASHRAE Applications Handbook.

Such pool enclosures shall have a maximum overall (roof/gables/sidewalls) U value of 0.25.

**SECTION 3109.0 EXTERIOR ENVELOPE REQUIREMENTS FOR
LOW RISE RESIDENTIAL BUILDINGS**

3109.1 Criteria for low rise residential buildings: The following requirements shall apply to all buildings and structures or portions thereof in use groups R-1, R-2, R-3, and R-4 (hotels, multi-family, and one- and two-family) that are heated or mechanically cooled and not more than three stories high.

1. All buildings in these use groups shall conform to the thermal transmittance values in Table 3109.1 or shall be designed to satisfy the requirements of Section 3109.3 or shall be designed to satisfy the requirements of Section 3115.
2. An overall U_o value of 0.167 for structures heated by oil, gas or heat pumps, or an overall U_o of 0.105 for structures heated by electric resistance may be used for the combination of walls, doors and windows containing heated space in lieu of the separate U values listed for walls, doors and windows. The overall U_o of 0.167 or 0.105 shall be used when the windows exceed fifteen per cent of the gross exterior wall area.
3. For purposes of this section only, framing members shall not be included in the calculations of R and U values.

TABLE 3109.1
MAXIMUM U VALUES AND MINIMUM R VALUES OF WALLS,
ROOF/CEILING, AND FLOORS
FOR RESIDENTIAL BUILDINGS OF SECTION 3109.1

ELEMENT	DESCRIPTION	U VALUE	TOTAL R VALUE	NOTE S
Walls	All wall construction containing heated or mechanically cooled space	0.08	12.5	1
	Electric resistance heating	0.05	20.0	1
Foundation Walls Including Band Joist	Containing heated or mechanically cooled space	0.08	12.5	-
	Containing unheated space	0.08	12.5	4
Roof/Ceiling Assembly	All roof construction containing heated or mechanically cooled space	0.033	30.0	-
Windows	All construction enclosing heated or mechanically cooled space	0.65	1.54	2
	Electric resistance heating	0.40	2.50	6, 7
Doors	All construction enclosing heated or mechanically cooled space	0.40	2.50	-
Floors	Floor sections over areas exposed to outside air or unheated space	0.05	20.0	3
	Slab on grade beneath conditioned space	-	10.0	5

Note 1: These values may be used when the doors and windows do not exceed fifteen (15) percent of the gross exterior wall area. When doors and windows exceed fifteen (15) percent of the gross wall area, see Section 3109.1, item 2.

Note 2: Double glazed primary windows or single glaze primary windows with storm windows will satisfy the required U value of zero point sixty-five (0.65).

Note 3: Insulation may be omitted from floors over unheated areas when foundation walls are provided with a U value of zero point zero eight (0.08).

Note 4: The U value requirement of zero point zero eight for foundation walls may be omitted when floors over unheated spaces are provided with a U value of zero point zero five (0.05).
 (Table notes continued on next page)

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Note 5: R value for perimeter insulation (see Section 3106.4.6).

Note 6: When doors and windows do not exceed fifteen (15) percent of the gross exterior wall area, this value may be used. When doors and windows do not exceed ten (10) percent of the gross exterior wall area, windows having a U value of 0.65 (R value of 1.54) may be used. When windows and doors exceed fifteen (15) percent of the gross exterior wall area, see Section 3109.1, item 2.

Note 7: Double glazed primary windows with storm windows or most triple glazed primary windows or double glazed low emissivity primary windows will satisfy the required U value of zero point forty (0.40).

3109.2 Calculation of Uo: Separate overall thermal transmittance values shall be calculated for wall assemblies, roof/ceiling assemblies, and floors. Equation 1 is provided as an example of the Uo calculation for walls.

$$\text{Equation 1: Overall wall } U_o = \frac{U_w A_w + U_g A_g + U_d A_d}{A}$$

Where:

U_o = average or combined transmittance of the gross exterior wall; (Btu/hr-ft²-°F).

A_w = gross exterior wall area; (ft²).

U_w = thermal transmittance of the components of the opaque wall; (Btu/hr-ft²-°F).

A_w = opaque wall area; (ft²).

U_g = thermal transmittance of the windows; (Btu/hr-ft²-°F).

A_g = window area; (ft²).

U_d = thermal transmittance of the door or similar opening; (Btu/hr-ft²-°F).

A_d = door area; (ft²).

NOTE: Where U_g is determined by test, it shall be calculated using the procedure contained in Section 3114.3.2.2 including calculation for framing, sash, edge effects, and all other factors pertinent to the complete window assembly.

3109.3 Alternates: The stated U_o (or U) value of any one assembly, such as roof/ceiling, wall, or floor, may be increased and the U_o (or U) value for other components decreased provided that the overall heat gain or loss for the entire building envelope does not exceed the total resulting from conformance to the stated U_o (or U) values.

SECTION 3110.0 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) SYSTEMS

3110.1 Scope: This section covers the determination of heating and cooling loads, systems performance, and control requirements for all buildings. Criteria are established for insulating HVAC systems and for duct construction.

Exception: Special applications, including but not limited to hospitals, museums, laboratories, rooms containing thermally sensitive equipment such as computers, open refrigerated display cases, may be exempted from the requirements of this section, when calculations and requirements are submitted establishing the unique environmental criteria that exist.

3110.2 Calculation of heating and cooling loads

3110.2.1 Calculation procedures: For the purpose of sizing HVAC systems, heating and cooling design loads shall be determined in accordance with techniques recommended in the 1985 ASHRAE Handbook of Fundamentals or the Air Conditioning Contractors Association's Manual "J". The design parameters specified in Section 3105.0 shall apply for all computations.

3110.3.1 System heating/cooling capacity: The rated output capacity of the heating/cooling system at design conditions shall not be greater than one hundred twenty-five (125) per cent of the design load calculated in accordance with this article. Equipment designed for standby purposes is not included in the capacity limitation requirement. For a single piece of equipment which has both heating and cooling capability, only one function, either the heating or the cooling, need meet the requirements of this section. Capacity for the other function shall be, within available equipment options, the smallest size necessary to meet the load.

Exception: Where the HVAC system for the building uses interconnected equipment designed to sequence with the load and it can be shown that such design will use less energy on an annual basis than one large unit.

3110.3.2 Heat pump supplementary heating capacity: The rated output capacity of a heat pump supplementary heating source shall not be greater than one-hundred twenty-five (125) percent of the design load as calculated in accordance with this article.

3110.4 Simultaneous heating and cooling: Simultaneous heating and cooling by reheating or recooling supply air or by concurrent operation of independent heating and cooling systems serving a common zone shall be restricted as delineated below:

3110.4.1 Recovered energy: Recovered energy, provided the new energy expended in the recovery process is less than the amount recovered, may be used for control of temperature and humidity. (New energy is defined as energy, other than recovered, utilized for the purpose of heating or cooling).

3110.4.2 New energy for humidity control: New energy may be used, when necessary, to prevent relative humidity from rising above fifty-three (53) per cent for comfort control or to prevent condensation on terminal units or outlets.

3110.4.3 New energy for temperature control: New energy may be used for control of temperature if minimized as delineated below:

1. Reheat systems: Systems employing reheat and serving more than one (1) zone, other than those employing variable air volume for temperature control, shall be provided with controls that will automatically reset the cold air supply. The temperature shall be controlled to sequence reheat and cooling.
2. Dual duct and multi zone systems: These systems shall be provided with controls that will automatically reset the cold deck air supply to the highest temperature that will satisfy the zone requiring the coolest air, and the hot deck air supply to the lowest temperature that will satisfy the zone requiring the warmest air.
3. Recooling systems: Systems in which heated air is recoolled, directly or indirectly, to maintain space temperature shall be provided with controls that will automatically reset the temperature to which the supply air is heated. The temperature shall be the lowest level that will satisfy the zone requiring the warmest air.
4. Multiple zones: For systems with multiple zones, one (1) or more zones may be chosen to represent a number of zones with similar heating/cooling characteristics. A multiple zone HVAC system that employs reheating or recooling for control of not more than five thousand (5,000) cubic feet per minute (cfm) or twenty (20) percent of the total supply air of the system, whichever is less, shall be exempt from the supply air temperature reset requirement of paragraphs 1 through 3.
5. Concurrent operation: Concurrent operation of independent heating and cooling systems serving common spaces and requiring the use of new

energy for heating or cooling shall be minimized by one (1) or both of the following:

- a. by providing sequential temperature control of both heating and cooling capacity in each zone; and/or
- b. by limiting the heating energy input through automatic reset control of the temperature of the heating medium to only that necessary to offset heat loss due to transmission and infiltration and, where applicable, to heat the ventilation air supply to the space.

3110.5 Mechanical ventilation: Each mechanical ventilation system (supply and/or exhaust) shall be equipped with motorized or other means of automatic volume shutoff or reduction during periods of non-use or alternate use of the spaces served by the system.

Exceptions:

1. For one- and two-family structures gravity dampers shall be allowed for bath and kitchen exhaust systems.
2. Systems serving areas expected to operate continuously.
3. For Systems which have a design air flow of 300 cfm or less, gravity dampers shall be allowed.
4. Gravity and other non-electrical ventilation systems may be controlled by readily accessible manual damper controls.
5. Where restricted by code, such as combustion air intakes.

3110.6 Fan system design criteria

3110.6.1 General: The following design criteria apply to all HVAC fan systems used for comfort heating, ventilating, and/or air conditioning. For the purposes of this section, the energy demand of a fan system is the sum of the demand of all fans which are required to operate at design conditions to supply air from the heating and/or cooling source to the conditioned space(s) and return it back to the source or exhaust it to the outdoors while bringing in outside air for ventilation.

Exceptions:

1. Systems with total fan system motor horsepower of 10 HP or less.
2. Unitary equipment for which fan energy is included in Section 3111 efficiency ratings.

3110.6.2 Constant volume fan systems: For fan systems which provide a constant air volume whenever the fans are operating, the power required by the motors for the combined fan system at design conditions shall not exceed 0.8 W/cfm.

3110.6.3 Variable air volume (VAV) fan systems

3110.6.3.1 For fan systems which are able to vary system air volume automatically as a function of load, the power required by the motors for the combined fan system at design conditions shall not exceed 1.25 W/cfm.

3110.6.3.2 Individual VAV fans with motors 75 HP and larger shall include controls and devices necessary for the fan motor to demand no more than 50% of design wattage at 50% of design air volume, based on manufacturer's test data.

3110.7 Controls:

3110.7.1 Temperature control: Each HVAC system shall be provided with at least one (1) thermostat for the regulation of temperature. Each thermostat shall be capable of being set as follows:

1. when used to control heating only, 55-75 degrees F;
2. when used to control cooling only, 70-85 degrees F; and
3. when used to control both heating and cooling it shall be capable of being set from 55-85 degrees F, and shall be capable of operating the system heating and cooling in sequence. It shall be adjustable to provide a temperature range of up to ten (10) degrees F between full heating and full cooling, except as allowed in Section 3110.4.3, item 5.

3110.7.2 Humidity control: If an HVAC system is equipped with a means for adding moisture to maintain specific selected relative humidities in spaces or zones, a humidistat shall be provided. This device shall be capable of being set to prevent new energy from being used to produce space relative humidity above thirty (30) per cent relative humidity. When a humidistat is used in an HVAC system for controlling moisture removal to maintain specific selected relative humidities in spaces or zones, it shall be capable of being set to prevent new energy from being used to produce a space relative humidity less than fifty-three (53) percent.

3110.7.3 Zoning for temperature control:

1. One- and two-family dwellings: At least one (1) thermostat for regulation of space temperature shall be provided for each separate HVAC system. In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each zone or floor.
2. Multi-family dwellings: For multi-family dwellings, each individual dwelling unit shall be considered separately and shall meet the above requirements. Spaces other than living units shall meet the requirements of item 3 following.
3. In all other types of buildings or occupancies, at least one (1) thermostat for regulation of space temperature shall be provided for:
 - a. each separate HVAC system; and
 - b. each separate zone as defined in Section 311.0. As a minimum, each floor of a building shall be considered as a separate zone. In a multi-story building in which the perimeter system offsets only the transmission losses of the exterior wall, an entire side of uniform exposure may be zoned separately. A readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input (for the exposure) to each floor.

3110.7.4 Control setback and shut-off: Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

3110.7.4.1 Residential occupancy (use groups R-2, R-3, and R-4): The thermostat required in paragraphs 1 and 2 of Section 3110.7.3, or an alternate means such as a switch or a clock, shall provide a readily accessible, manual or automatic means for reducing the energy required for heating and cooling during periods of nonuse or reduced need, such as, but not limited to, unoccupied periods and sleeping hours.

3110.7.4.2 Other buildings and occupancies: Each HVAC system shall be equipped with a readily accessible means of shutting off or reducing the energy used for HVAC during periods of nonuse or alternate uses of the building spaces or zones served by the system.

3110.7.4.3 Swimming pools:

1. Heated swimming pools shall be equipped with controls to limit heating water temperatures to not more than eighty (80) degrees F.

Exceptions:

1. Pools used for therapeutic purposes are exempt from this requirement when approved by the building official.
2. Uncovered (unenclosed) heated pools shall be controlled so that the electric or fossil fuel pool water heating systems are in operative whenever the outdoor air temperature is below sixty (60) degrees F.

3110.8 Duct construction: All air handling ductwork and plenums shall be constructed and erected in accordance with the appropriate Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standards.

3110.8.1 Ductwork which is intended to operate at static pressures in excess of 3 inches W.C. shall be leak tested and be in conformance with the following sections of the SMACNA Duct Leakage Test Manual, 1985: Test procedures shall be in accordance with those outlined in Section 5, or equivalent; test reports shall be provided in accordance with Section 6, or equivalent; the tested duct leakage class at a test pressure equal to the design duct pressure class rating shall be equal to or less than leakage class 6 as defined in Section 4.1. Leakage testing may be limited to representative sections of the duct system but in no case shall such tested sections include less than 25% of the total installed duct area for the designated pressure class.

3110.8.2 Where supply ductwork and plenums which are intended to operate at static pressures from 1/4 inch to 3 inches W.C. inclusive, are located outside of the conditioned space or in return plenums, joints shall be sealed in accordance with Seal Class C, as defined in the SMACNA manual referenced above. Pressure sensitive tape shall not be used as the primary sealant for such ducts which are intended to operate at static pressures of 1 inch W.C. or greater.

3110.8.3 Dampers: Automatic or manual dampers installed for the purpose of shutting off outside air intakes for ventilation air shall be designed with light tight shut-off characteristics to minimize air leakage.

3110.9 Air handling duct system insulation: All ducts, plenums and enclosures installed in or on buildings shall be thermally insulated as follows:

1. Air Handling System Insulation: All air handling ducts and plenums installed as part of an HVAC air distribution system shall be thermally insulated in accordance with Table 3110.9.

Exception: Duct insulation is not required in any of the following cases:

- a. Ducts located within the conditioned space they serve.

- b. Supply or return air ducts installed in unventilated crawl spaces with insulated walls, and basements or cellars with insulated walls in one- and two-family dwellings;
- c. When the heat gain or loss of the ducts, without insulation, will not increase the energy requirements of the building;
- d. Within HVAC equipment;
- e. Exhaust air ducts.

TABLE 3110.9¹
MINIMUM DUCT INSULATION

Duct Location	Cooling ² Insulation R-Value	Heating ² Insulation R-Value
Outside of building envelope or in spaces vented to the outside	5.0	6.5
Inside of building envelope: TD ³ ≤ 15	None Required	None Required
Inside of building envelope: 15 < TD ³ ≤ 30	3.3	3.3
Inside of building envelope: TD ³ > 30	5.0	5.0

Notes to Table 3110.9:

- ¹ Insulation R-values shown are for the insulation only and do not include film resistance. The required minimum thicknesses do not consider condensation. For ducts which are designed to convey both heated and cooled air, duct insulation shall be as required by the most restrictive condition. Where exterior walls are used as plenum walls, wall insulation shall be as required by the most restrictive condition of this Section or Section 3109 (low rise residential) or Section 3114 (high rise residential and commercial).
- ² Includes system return ducts.
- ³ TD is defined as the temperature difference at design conditions (see Section 3105) between the space within which the duct is located and the design air temperature in the duct.

2. Vapor barriers shall be provided, where required, to prevent condensation.

3110.10 Cooling with outdoor air (economizer cycle): Each fan system shall be designed to use up to and including one hundred (100) per cent of the fan system capacity for cooling with outdoor air automatically whenever its use will result in lower usage of new energy. Activation of economizer cycle shall be controlled by sensing outdoor air enthalpy and dry bulb temperature jointly or outdoor air dry bulb temperature alone to accomplish the above.

Exceptions: Cooling with outdoor air is not required under any one (1) or more of the following conditions:

1. Fan system capacity less than five thousand (5,000) cubic feet per minute (cfm) or one hundred thirty-four thousand (134,000) Btu/h of total cooling capacity;
2. The quality of the outdoor air is so poor as to require extensive treatment of the air;
3. The need for humidification or dehumidification requires the use of more energy than is conserved by the outdoor air cooling;
4. The use of outdoor air cooling may affect the operation of other systems so as to increase the overall energy consumption of the building;
5. Internal/external zone heat recovery or other energy recovery is used;
6. When all space cooling is accomplished by a circulating liquid which transfers space heat directly or indirectly to a heat rejection device such as a cooling tower without the use of a refrigeration system.

3110.11 Balancing: The HVAC system design shall provide means for balancing the air and water systems such as but not limited to dampers, temperature and pressure test connections, flow measuring stations or meters, and balancing valves. The HVAC systems shall be field balanced to achieve conditions stated in the plans and specifications.

3110.12 Piping insulation: All piping installed to serve buildings and within buildings shall be thermally insulated in accordance with Table 3110.12.

Exceptions: Piping insulation is not required in any of the following cases:

1. Piping installed within HVAC equipment;
2. Piping for fluids at temperatures between fifty-five (55) degrees F and one hundred and five (105) degrees F;
3. When the heat loss and/or heat gain of the piping, without insulation, does not increase the heating and/or cooling energy requirements of the building;
4. Piping, installed in unventilated crawl spaces with insulated walls, and basements or cellars with insulated walls in one- and two-family dwellings.

3110.12.1 Other insulation thickness: Insulation thicknesses in Table 3110.12 are based on insulation with thermal conductivities listed in Table 3110.12 for each fluid operating temperature range, rated in accordance with ASTM C 335-79, Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulations, at the average temperature listed in the Table. For insulation which has a conductivity more than 10% in excess of that shown in Table 3110.12 for the applicable fluid operation temperature range and at the average rating temperature shown, minimum thicknesses shall be determined in accordance with equation 3110.12.1:

$$T = PR \times [(1 + t/PR)^{K/k-1}] \quad \text{Equation 3110.12.1}$$

Where:

T = new minimum insulation thickness for material with conductivity K, inches.

PR = pipe actual outside radius, inches

t = insulation thickness from Table 3110.12, inches.

K = conductivity of alternate material at the average rating temperature indicated in Table 3110.12 for the applicable fluid temperature range, (Btu-inch/h-°F-ft²).

k = conductivity listed in Table 3110.12 for the applicable fluid temperature range, (Btu-inch/h-°F-ft²).

3110.12.2 Vapor barriers: Vapor barriers shall be provided to prevent condensation where required.

Table 3110.12
MINIMUM PIPE INSULATION¹
INSULATION THICKNESS IN INCHES FOR PIPE SIZES (Note 2)

PIPING SYSTEM TYPES	FLUID TEMPERATURE RANGE (°F)	RUNOUTS ² UP TO 2"	1" & LESS	1 1/4" TO 2"	2 1/2" TO 4"	5" TO 6"	8" AND LARGER	INSULATION CONDUCTIVITY (B-in/F-hr-sf) at temp °F
HEATING SYSTEMS Steam & Hot Water								
High Press./Temp.	351-450	1.5	2.5	2.5	3.0	3.5	3.5	0.32 @ 250°
Med. Press./Temp.	251-350	1.5	2.0	2.5	2.5	3.5	3.5	0.29 @ 200°
Low Press./Temp.	201-250	1.0	1.5	1.5	2.0	2.0	3.5	0.27 @ 150°
Low Temp.	141-200	0.5	1.5	1.5	1.5	1.5	1.5	0.25 @ 125°
Low Temp.	105-140	0.5	1.0	1.0	1.0	1.5	1.5	0.24 @ 100°
Steam Condensate (for feedwater)	Any	1.0	1.5	1.5	2.0	2.0	2.0	0.27 @ 150°
COOLING ³ SYSTEMS								
Chilled Water	40-55	0.5	0.5	0.75	1.0	1.0	1.0	0.23 @ 75°
Refrigerant or Brine	Below 55	1.0	1.0	1.5	1.5	1.5	1.5	0.23 @ 75°

Notes:

- For minimum thicknesses of alternative insulation types, see Section 3110.12.1.
- Runouts to individual terminal units not exceeding 12 ft. in length.
- The required minimum thicknesses do not consider condensation. Additional insulation and/or vapor barriers may be required to prevent condensation.

SECTION 3111.0 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

3111.1 Scope: This section applies to all buildings.

3111.2 HVAC equipment performance requirements: The requirements of this section apply to equipment and component performance for heating, ventilating, and air conditioning systems. Where equipment efficiency levels are specified, data furnished by the equipment supplier, or certified under a nationally recognized certification program or rating procedure, shall be used to satisfy these requirements.

3111.3 HVAC system combustion heating equipment: All gas and oil fired comfort heating equipment shall have an Annual Fuel Utilization Efficiency (AFUE) not less than the values shown in Table 3111.3. Equipment types not covered in these tables shall show a minimum combustion efficiency of seventy-five (75) per cent at maximum rated output. Combustion efficiency is defined as one hundred (100) percent minus stack losses in per cent of heat input. Stack losses are:

1. loss due to sensible heat in dry flue gas;
2. loss due to incomplete combustion; and
3. loss due to sensible and latent heat in moisture formed by combustion of hydrogen in the flue.

**TABLE 3111.3
MINIMUM ANNUAL FUEL UTILIZATION EFFICIENCY
- FOSSIL FUEL HEATING -**

EQUIPMENT	MINIMUM AFUE
Gas Boilers < 300,000 Btu/hr	68%
Oil Boilers < 300,000 Btu/hr	77%
Gas Furnaces < 225,000 Btu/hr	68%
Oil Furnaces < 225,000 Btu/hr	77%

3111.4 HVAC system heating equipment, heat pumps heating mode: Heat pumps whose energy input is entirely electric shall show a coefficient of performance (COP heating, as defined herein) not less than the values shown in Table 3111.4.

1. These requirements apply to, but are not limited to, unitary heat pumps (air source) in the heating mode, and to packaged terminal heat pumps in the heating mode. Field assembled unitary heat pumps, consisting of one (1) or more components, shall show compliance with this section.

2. Coefficient of performance heating: the ratio of the rate of net heat output to the rate of total on-site energy input, expressed in consistent units and under designated rating conditions. The rate of net heat output shall be defined as the change in the total heat content of the air between entering and leaving the equipment (not including supplementary heat).
3. Supplementary heater: The heat pump shall be installed with a control to prevent supplementary heater operation when the heating load can be met by the heat pump alone. Supplementary heater operation is permitted during transient periods, such as start-ups, following room thermostat set-point advance and during defrost. A two (2) stage thermostat, which controls the supplementary heat on its second stage, shall be accepted as meeting this requirement. The cut-on temperature for the compression heating shall be higher than the cut-on temperature for the supplementary heat, and the cut-off temperature for the compression heating shall be higher than the cut-off temperature for the supplementary heat. Supplementary heat may be derived from any source of electric resistance heating or combustion heating.

**TABLE 3111.4
MINIMUM COP FOR HEAT PUMPS, HEATING MODE**

CATEGORY	PERFORMANCE	REFERENCE STANDARD(S)
Air Source, single phase: (Cooling capacity less than 65,000 Btu/hr)	Hi-temp (47db/43wb); (Min. COP = 2.7) Low-temp (17db/15wb); (Min. COP = 1.8)	ARI 210-81 ARI 240-81 ARI 210/240-84
Air Source, three phase: (Cooling capacity less than 35,000 Btu/hr)	Hi-temp (47db/43wb); (Min. COP = 2.7) Low-temp (17db/15wb); (Min. COP = 1.8)	
Packaged Terminal Heat Pumps	Min. COP = 2.5	

3111.5 HVAC system equipment, electrically operated cooling mode:

HVAC system equipment as listed below whose energy input in the cooling mode is entirely electric shall show a Seasonal Energy Efficiency Ratio (SEER) or Energy Efficiency Ratio (EER) not less than the values shown in Table 3111.5.

3111.5.1 These requirements apply to, but are not limited to, unitary cooling equipment (air-cooled, water-cooled, and evaporatively cooled); the cooling mode of unitary heat pumps; and packaged terminal air conditioners.

TABLE 3111.5
MINIMUM SEER AND EER FOR ELECTRICALLY DRIVEN
AIR CONDITIONING EQUIPMENT

TYPE	PERFORMANCE	REFERENCE STANDARD(S)
Air, single phase: (Cooling capacity less than 65,000 Btu/hr)	Min. SEER = 7.8	ARI 210-81 ARI 210/240-84
Air, three phase: (Cooling capacity less than 65,000 Btu/hr)	Min. EER (Hi-temp) = 6.2	
Air: (Cooling capacity greater than 65,000 Btu/hr but less than 135,000 Btu/hr)	Min. EER (Hi-temp) = 8.2	
Packaged Terminal Heat Pump	Min. EER = 7.8	
Packaged Terminal Air Conditioner	Min. EER = 7.8	

3111.6 Applied HVAC system components, electrically operated cooling mode: HVAC system components, as listed in Table 3111.6, whose energy input is entirely electric shall show a coefficient of performance (COP) cooling, as defined herein, not less than the values shown in Table 3111.6.

3111.6.1 Coefficient of performance: Coefficient of Performance (COP) cooling is the ratio of the rate of net heat removal to the rate of total energy input, expressed in consistent units and under designated rating conditions.

The rate of net heat removal is defined as the difference in total heat content of the water or refrigerant entering and leaving the component.

Total on-site energy input shall be determined by combining the energy inputs to all elements and accessories of the component, including but not limited to compressors, internal circulating pumps, purge, and the HVAC system component control circuit.

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**TABLE 3111.6
MINIMUM EER AND COP FOR ELECTRICALLY DRIVEN AIR CONDITIONING
SYSTEM COMPONENTS**

Component	Condensing Means	Coolant	EER	COP	Reference Standard
Self-Contained Chillers	Centrifugal	Air	8.2	2.4	ARI 550-83
Self-Contained Chillers	Centrifugal < 250 Tons	Water	16.4	4.8	ARI 550-83
Self-Contained Chillers	Centrifugal > 250 Tons	Water	17.1	5.0	ARI 550-83
Self-Contained Chillers	Rotary	Air	8.2	2.4	ARI 550-83
Self-Contained Chillers	Rotary	Water	14.0	4.1	ARI 550-83
Self-Contained Chillers - with Condenser	Positive Displacement	Air	8.9	2.6	ARI 590-81
Self-Contained Chillers - with Condenser	Positive Displacement	Water	12.6	3.7	ARI 590-81
Self-Contained Chillers - without Condenser	Positive Displacement	Air	10.1	3.0	ARI 590-81
Condenser Units 135,000 Btu/hr or Less		Air	9.5	2.8	ARI 365-85
Condenser Units 135,000 Btu/hr or Less		Water (Evap)	12.7	3.7	ARI 365-85

3111.7 HVAC system equipment, heat operated, cooling mode: Heat operated cooling equipment shall show a coefficient of performance (COP) cooling not less than the values shown in Table 3111.7. These requirements apply to, but are not limited to, absorption equipment, engine driven equipment, and turbine drive equipment.

When the refrigeration components are supplied by different manufacturers, it shall be the responsibility of the system designer to determine compliance with these requirements, using data provided by the suppliers of the elements.

**TABLE 3111.7
MINIMUM COP FOR HEAT OPERATED
AIR CONDITIONING SYSTEM EQUIPMENT**

HEAT SOURCE	MINIMUM COP
Direct fired (gas/oil)	0.48
Indirect fired (steam/hot water)	0.68

SECTION 3112.0 ELECTRICAL POWER DISTRIBUTION

3112.1 Scope: Electrical distribution systems shall be designed for the efficient distribution of electrical energy from the service entrance to the points of use.

3112.1.1 Exempt buildings: Buildings in use groups R-3 and R-4 (one-and two-family dwellings) shall be exempt from the requirements of this section.

3112.2 Power factor: Utilization equipment greater than one thousand (1,000) watts and lighting equipment greater than fifteen (15) watts with an inductive reactance load component shall have a power factor of not less than eighty-five (85) per cent under rated load conditions. Power factor of less than eighty-five (85) per cent shall be corrected to at least ninety (90) per cent under rated load conditions. Power factor corrective devices, installed to comply with this code, shall be switched with the utilization equipment, except where this results in an unsafe condition or interferes with the intended operation of the equipment.

3112.3 Service voltage: Where a choice of service voltage is available, a computation shall be made to determine which service voltage would produce the least energy loss, and that voltage shall be selected.

3112.4 Electric energy determination: In all multi-family dwellings, each dwelling unit shall be separately metered.

Exceptions:

1. Publicly financed housing for the elderly with fuel fired heating systems, with centrally operated air conditioning systems, or without air conditioning systems are exempt from this requirement.
2. Publicly financed housing for the elderly with electric resistance or storage heating systems are exempt from this requirement provided there is informational metering of the individual dwelling units.

SECTION 3113.0 LIGHTING SYSTEMS

3113.1 Scope: This section establishes the maximum power limits and control requirements for interior and exterior illumination systems.

3113.1.1 The rooms, spaces and areas covered by this section include:

1. Interior spaces of buildings.
2. Building exterior areas such as: entrances, exits, loading docks, etc.
3. Roads, grounds and other exterior areas including open-air covered areas where lighting is required and is energized through the building electrical service.

3113.1.2 Exempt buildings and spaces: The following buildings and spaces are exempt from the provisions of this section:

1. Lighting for dwellings units contained in use groups R-2, R-3 and R-4, except for the switching requirements in 3113.2.2.1.
2. Outdoor activities such as manufacturing, storage, commercial green houses and processing facilities.
3. Lighting power for theatrical productions, television broadcasting, audio-visual presentations and those portions of entertainment facilities where lighting is an essential technical element for the function performed.
4. Specialized luminaires for medical and dental purposes.
5. Outdoor athletic facilities.
6. Display lighting required for art exhibits or displays in galleries, museums and monuments.
7. Exterior lighting for public monuments and recognized landmarks such as buildings individually listed on the National Register of Historic Places.
8. Special lighting needs for research.
9. Lighting to be used solely for indoor plant growth during the hours of 10:00 p.m. to 6:00 a.m.

10. Emergency lighting that is automatically "off" during normal operation.
11. High risk security areas identified by local ordinances or regulations or by security or safety personnel as requiring additional lighting.
12. Classrooms specifically designed for the hard of seeing, hard of hearing (lip-reading), and for senior citizens.
13. Lighting for signs.
14. Store-front display windows in retail facilities.
15. Spaces regularly used for religious services or worship.

3113.2 Minimum requirements: This sub-section establishes the minimum requirements which must be met for all spaces covered by Section 3113.0.

3113.2.1 Building Lighting Power Limit (BLPL): A Building Lighting Power Limit (BLPL) is the upper limit of the power to be available to provide the lighting needs of a building.

The Building Lighting Power Limit (BLPL) is the sum of the building Exterior Lighting Power Allowance (ELPA), the Roads and Grounds Lighting Power Allowance (RLPA), and the building Interior Lighting Power Limit (ILPL).

1. The building Exterior Lighting Power Allowance (ELPA) is calculated in Section 3113.2.1.4.
2. The Roads and Grounds Lighting Power Allowance (RLPA) is calculated in Section 3113.2.1.5.
3. The building Interior Lighting Power Limit (ILPL) may be calculated either by the prescriptive criteria in Section 3113.4 or by the system performance criteria in Section 3113.5.

The prescriptive criteria (3113.4) provide a simple calculation procedure with limited flexibility. The system performance criteria (3113.5) provide a more complex and lengthy calculation procedure with greater flexibility usually suitable for complex lighting systems in larger buildings.

When using the system performance criteria (3113.5) a computer-based procedure, approved by the State Board of Building Regulations and Standards, may be used to calculate the ILPL compliance value.

3113.2.1.1 Compliance: A building design shall be considered in compliance with this section if:

1. The exterior lighting power to be installed is no greater than the Exterior Lighting Power Allowance (ELPA).

2. The roads and ground lighting power to be installed is not greater than the Roads and Grounds Lighting Power Allowance (RLPA).
3. The interior lighting power to be installed is not greater than the Interior Lighting Power Limit (ILPL). Tradeoffs between ILPL and ELPA or RLPA shall not be allowed (also see Section 3113.2.1.2 below).

3113.2.1.2 Compliance for multiple buildings of a facility: The lighting power limits for each building in a facility shall be calculated separately. Tradeoffs among buildings shall be restricted as described below:

1. Tradeoffs of Interior Lighting Power Limits among other buildings of the same facility shall not be allowed.
2. Tradeoffs between Interior Lighting Power Limits and Exterior Lighting Power Allowances or Roads and Grounds Power Allowances shall not be allowed.
3. Tradeoffs of Exterior Lighting Power Allowances among buildings of the same facility are allowed.

3113.2.1.3 Forms for compliance: Forms approved by the Board of Building Regulations and Standards, when such Forms exist, shall be completed to show compliance with this section, as follows:

1. To summarize the total Exterior Lighting Power Allowance (ELPA).
2. To summarize the maximum Road and Grounds Lighting Power Allowance (RLPA).
3. To summarize the maximum Building or Facility Lighting Power Limit (BLPL, FLPL). The BLPL or FLPL shall be the sum of the ILPL and the ELPA of the building (or of all buildings) and the RLPA of the road and grounds.
4. If the prescriptive criteria of Section 3113.4 are used to determine the Interior Lighting Power Limit (ILPL), then an approved form shall be used to summarize the maximum Interior Lighting Power Limit.
5. If the system performance criteria of Section 3113.5 are used to determine the interior lighting power limit (ILPL), then an approved form (or an equivalent computer generated printout) shall be used to summarize the Interior Lighting Power Limit.

3113.2.1.4 Exterior Lighting Power Allowance (ELPA): Lighting power for building exteriors shall not exceed the values given in Table 3113.2.1.4 in accordance with the activities to be performed.

**TABLE 3113.2.1.4
MAXIMUM LIGHTING POWER ALLOWANCES (CONNECTED LOAD)
FOR BUILDING EXTERIORS**

LOCATION	ALLOWANCE ¹
Exit (with or without a canopy)	20 W/lin. ft. of door opening
Entrance (without a canopy)	30 W/lin. ft. of door opening
Entrance (with a canopy)	10 W/ft ² of canopied area
High traffic (retail, hotel, airport, theater, etc.)	
Light traffic (hospital, office, school, etc.)	4 W/ft ² of canopied area
Loading area	0.030 W/ft ²
Loading door	20 W/lin. ft. of door opening

NOTE: Total illumination allowance for the building is 10 W/Lin. Ft. exterior (including the above allowances) of building perimeter.

3113.2.1.5 Roads and Grounds Power Allowance (RLPA): Lighting power for roads and grounds shall not exceed the values in Table 3113.2.1.5.

**TABLE 3113.2.1.5
MAXIMUM LIGHTING POWER ALLOWANCES (CONNECTED LOAD)
FOR ROADS AND GROUNDS**

LOCATION	ALLOWANCE
Storage and work areas	0.20 W/ft ²
Other activity areas for casual use such as picnic grounds, gardens, parks, and other landscaped areas	0.10 W/ft ²
Private driveways/walkways	0.10 W/ft ²
Public driveways/walkways	0.15 W/ft ²
Private parking lots	0.12 W/ft ²
Public parking lots	0.18 W/ft ²

3113.2.2 Interior and exterior lighting controls: All lighting systems except those required for emergency or exit lightings shall be provided with manual, automatic or programmable controls.

3113.2.2.1 Minimum number of lighting controls:

1. Each area enclosed by ceiling height partitions shall have independent control of the lighting within that area.
2. The maximum area to be controlled by a single switch shall be seven hundred and fifty (750) square feet. The total number of switches shall be not less than one switch for each sixteen hundred (1600) watts (@ 277 volts) of connected load, or one switch for each twelve hundred and fifty (1250) watts (@ 120 volts) of connected load.

Exception: Lighting control requirements for spaces which must be used as a whole and operate during well defined periods of the 24 hour day shall be exempt from item 2 above, if all the lighting is automatically controlled such that during non-business hours (from one-half hour after closing to one-half hour before opening) two-thirds of the connected load is shut off, or the operating connected load does not exceed seven-tenths (0.7) watts per square foot. (Examples of such spaces may include retail and department stores, warehouses, service corridors, public lobbies of office buildings and other such spaces.)

Lighting requirements for other spaces which must be used as a whole but are not operated during well defined periods of the day and therefore may be utilized during any period of the 24 hour day, may be controlled by a lesser number of controls, but not less than one control point for each fifteen hundred (1500) watts of connected lighting power, or a total of three (3) control points, whichever is greater. Lighting in such spaces shall be controlled in accordance with the work activities. (Examples of such spaces may include the public lobbies of hotels and hospitals and other such spaces, all under central supervision.)

3. Hotel and motel guest rooms excluding bathrooms shall have one or more master switches at the door that turn off all permanently wired lighting fixtures and switched receptacles. For multiple room hotel suites, switches at the entry of each room, in lieu of the switch at the main door, will be acceptable to meet these requirements.
4. Bathrooms in hotels and motels shall have a switchable, permanently installed night light with a maximum wattage of five (5) watts.
5. Switches controlling the same load from more than one location shall not be credited as increasing the number of controls to meet the requirements of this Section.

6. All task lighting shall be separately controlled. There shall be at least one switch per task area. Switches for task lighting may be incorporated as part of the lighting fixture.

Exceptions:

1. Lighting controls for spaces which must be used as a whole, such as public lobbies of office buildings, hotels, and hospitals; and warehouses, storerooms and service corridors under centralized supervision may be centralized in remote locations.

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2. Manual and automatic control devices may reduce the number of controls required as listed in Table 3113.2.2.

TABLE 3113.2.2
REDUCTION ALLOWANCE FOR SELECTED CONTROLS

TYPE OF CONTROL	EQUIVALENT NUMBER OF CONTROL POINTS
Occupancy sensors	2
Timer - Programmable from the space being controlled	2
Three level, including off, step control or pre-set dimming	2
Four level, including off, step control or pre-set dimming	3
Automatic or continuous dimming	3

3113.2.2.2 Accessibility of switches: All switching devices used to control lighting within an area shall be readily accessible to personnel occupying that area.

Exceptions:

1. Lighting controls for spaces which must be used a whole, such as public lobbies of office buildings, hotels, and hospitals; retail and department stores and warehouses, storerooms and service corridors under centralized supervision may be centralized in remote locations.
2. Automatic controls
3. Programmable controls
4. Controls requiring trained operators.
5. Controls for safety hazards and security.

3113.2.2.3 Exterior lighting controls: In all exterior areas, lighting fixtures shall be automatically switched for non-operation when natural light is available except where security considerations would dictate otherwise.

3113.2.3 Ballasts

3113.2.3.1 Fluorescent lamp ballasts: Fluorescent lamp ballasts which have all the following characteristics shall meet or exceed the minimum ballast efficiency factor as shown in Table 3113.2.3.

1. Operate at nominal input voltages of 120 or 277 volts;
2. Have a power factor equal to or greater than 0.60 for a single F40T12 lamp;

3. Used to operate either F40T12 or F96T12 lamps as specified in Table 3113.2.3;
4. Designed for use at temperatures above 0°F;
5. Not specifically designed for use with dimming controls.

**TABLE 3113.2.3
MINIMUM BALLAST EFFICIENCY FACTOR**

BALLAST TYPE	BALLAST EFFICIENCY FACTOR
One - 4 foot lamp	1.805
Two - 4 foot lamps (120 V)	1.06
Two - 4 foot lamps (277 V)	1.05
Two - 8 foot slimline lamps	0.57
Two - 8 foot high output rapid start lamps	0.39

Note: The Ballast efficiency factor shall be calculated in accordance with Equation 3113.2.3.1:

$$\text{BEF} = \frac{\text{BF}}{\text{Power Input}} \quad \text{Equation 3113.2.3.1}$$

where:

BEF = Ballast efficiency factor
 BF = Ballast factor, expressed as a percent (also known as Relative Light Output)
 Power Input = Total wattage of combined lamps and ballasts

Tests for ballast factor and power input shall be in accordance with ANSI Standard C82.2 1984 Method of Measurement for Fluorescent Lamps Ballasts using Standard Lamps.

3113.2.3.2 One-lamp or three-lamp fluorescent luminaires recess-mounted within ten (10) feet center-to-center of each other or pendant-mounted or surface-mounted within one (1) foot of each other, and within the same room, shall be tandem wired to eliminate unnecessary use of single-lamp ballast.

3113.2.3.3 Ballasts shall have a power factor greater than 90%.

Exception:

1. Ballasts for circline and compact fluorescent lamps and low wattage high intensity discharge lamps of less than 100 watts.
2. Dimming ballasts.

3113.3 Interior lighting power adjustment factors

3113.3.1 Adjusted Lighting Power (ALP): When determining interior lighting compliance in Section 3113.4 or 3113.5, the Connected Lighting Power (CLP) for lights controlled by normal switching must not exceed the Interior Lighting Power Limit (ILPL). However, when the switching controls are automatic (i.e. daylight sensors, occupancy sensors, or lumen maintenance controls) the connected lighting power may exceed the ILPL provided that the Adjusted Lighting Power (ALP), calculated using equation 3113.3.1 does not exceed the ILPL.

$$ALP = CLP \times PAF \qquad \text{Equation 3113.3.1}$$

Where:

ALP = Adjusted Lighting Power, watts

CLP = Connected Lighting Power for the luminaires controlled by the automatic control device, watts

PAF = Power Adjustment Factor

3113.3.2 Power Adjustment Factor (PAF): The Power Adjustment Factor is limited to the specific area controlled by the automatic control device. The Power Adjustment Factor shall be as shown in Table 3113.3.2.

3113.3.3 Daylighting credits: Where daylighting credit is utilized, based on the procedures in Sections 3113.2.2.1 or 3113.3.2, automatic controls such as photoelectric switches or automatic dimmers shall be provided in the daylighted spaces.

**TABLE 3113.3.2
POWER ADJUSTMENT FACTOR (PAF)**

AUTOMATIC CONTROL DEVICE	PAF
1. Occupancy sensors	0.70
2. Daylighting sensors	
a) Continuous dimming	0.70
b) Multiple step control	0.80
c) On-off control	0.90
3. Lumen maintenance control	0.90
4. Combination of 1. and 2. above	0.60
5. Combination of 1. and 3. above	0.65
6. Combination of 1., 2 and 3. above	0.55
7. Programmable timing control	0.85

Notes:

1. PAF credits shall not be applied to the dimming controls of incandescent lamps or luminaires.
2. Only one adjustment factor may be used for each building space or luminaire, and 50% or more of the luminaire shall be within the applicable space to qualify for the power adjustment factor. Controls shall be installed in series with the lights and in series with all manual switching devices in order to qualify for an adjustment factor.
3. Daylighting controls shall be able to reduce electrical power consumption for lighting, continuously or in two or more steps, to 50% or less of maximum power consumption; shall control all luminaires more than 50% within a daylighted space, and shall not control any luminaire more than 50% outside a daylighted space.
4. Programmable timing controls used for credit in conjunction with Table 3113.3.2 shall be capable of:
 - a. programming different schedules for week days and weekends.
 - b. temporary override by occupants with automatic return to the original schedules. Override controls shall be readily accessible.
 - c. providing independent control of each lighting load which is required to be separately controlled.

3113.4 Prescriptive criteria: These prescriptive lighting requirements shall be used with Section 3113.2 and 3113.3. Section 3113.5 may be used instead of this section.

3113.4.1 Interior Lighting Power Limit (ILPL) calculation: Installed adjusted lighting power, including supplemental or task lighting provided by fixtures permanently wired in place but not by movable fixtures shall comply with the power limits established in this section. To establish a lighting power allowance, the following procedure shall be used:

1. Determine the space use categories and Unit Lighting Power Allowances (ULPA) for the various parts of the building from Table 3113.4.1. If a space use intended for the building is not listed in Table 3113.4.1, then the closest related building or space type listed in the Table shall be used.
2. Multiply the Unit Lighting Power Allowance (ULPA) for each space use category by the gross floor area included in that space use category.
3. Add the total number of watts for each area to arrive at the Interior Lighting Power Limit (ILPL) for the building.
4. In all cases of alterations or additions to existing buildings, the Unit Lighting Power Allowance (ULPA) for the new or altered area shall be calculated using Building Size Ranges in Table 3114.4.1 determined by combining the square footage of each category represented in such alterations or additions with the total square footage of the respective categories of the building.

3113.4.2 Compliance: A building shall be considered in compliance with this section if the interior Adjusted Lighting Power (ALP) to be installed, as determined in 3113.3.1, does not exceed the Interior Lighting Power Limit (ILPL) for the building, as determined in 3113.4.1.

**TABLE 3113.4.1
UNIT LIGHTING POWER ALLOWANCE (ULPA), W/ft²**

BUILDING SIZE RANGE, Ft ²					
BUILDING SPACE/TYPE	Less than 6,000	6,001 to 15,000	15,001 to 30,000	30,001 to 50,000	50,001 or more
Food Service					
Fast Food/Cafeteria	1.5	1.4	1.3	1.3	1.3
Leisure Dining/Bar	2.2	1.9	1.7	1.5	1.4
Offices	1.9	1.8	1.7	1.6	1.5
Retail ¹					
Type B & C ²	3.3	2.8	2.5	2.3	2.1
Type D & E ³	3.0	2.5	2.2	2.0	1.8
Mall Concourse at multi-store shopping centers	1.4	1.4	1.3	1.3	1.2
Garages and Basements	0.3	0.3	0.2	0.2	0.2
Schools					
Pre-High School	1.8	1.8	1.7	1.6	1.5
High School/Technical					1.8
University	2.0	2.0	2.0	1.9	
Warehouse/Storage	0.8	0.6	0.5	0.5	0.4
Factory and Workshop ⁴	1.2	1.1	1.0	1.0	1.0

Notes:

- 1 Includes general merchandising and display lighting.
- 2 Type B & C Retail: Fine Merchandising and Mass Merchandising.
- 3 Type D & E Retail: General Merchandising and Food and Miscellaneous Merchandising.
- 4 General lighting.

3113.5 System performance criteria: These system performance lighting requirements shall be used with the minimum requirements specified in Sections 3113.2 and 3113.3. The prescriptive criteria listed in Section 3113.4 may be used instead of this Section (Note that if Section 3113.5, "System Performance Criteria", is employed, a supplemental computer program, available through the State House Bookstore is available to assist in such analysis).

NOTE: A COMPUTER SOFTWARE PROGRAM, *LGTSTD* (LIGHTING STANDARD) IS AVAILABLE TO PERFORM SECTION 3113.5 EVALUATION. THIS PROGRAM PERFORMS PASS/FAIL ANALYSIS.

THE *LGTSTD* SOFTWARE PROGRAM, ALONG WITH THE *ENVSTD* SOFTWARE PROGRAM (SEE SECTION 3114.5) ARE COMBINED ON A SINGLE 5 1/4" FLOPPY DISC AND THIS DISC, PLUS A USER'S MANUAL FOR BOTH PROGRAMS, ARE AVAILABLE THROUGH THE STATE BOOKSTORE (617) 727-2834.

3113.5.1 Unit power density procedure: Installed Adjusted Lighting Power (ALP), including supplemental or task related lighting provided by movable fixtures shall comply with the power allowances established in this section.

3113.5.1.1 The Lighting Power Budget (LPB) of each interior space shall be determined in accordance with equation 3113.5.1.

$$\text{LPB} = A \times \text{Pb} \times \text{AF} \qquad \text{Equation 3113.5.1}$$

where:

LPB	=	Lighting power budget of the space, watts
A	=	Area of the space, ft ²
Pb	=	Base UPD, w/ft ² (Table 3113.5.1)
AF	=	Area factor of the space (Figure 3113.5.1)

1. The Room Area (A) shall be calculated from the inside dimensions of the room.
2. The Base UPD (Pb) shall be selected from Table 3113.5.1. For applications to areas or activities other than those given, select values for similar areas or activities.
3. The Area Factor (AF) shall be determined from Figure 3113.5.1 based on the room area and ceiling height. Rooms of identical ceiling height and activities may be listed as a group. The AF of a group of rooms shall be determined from the average area of these rooms.

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3113.5.1.2 Special Spaces and Activities

1. **Multi-Function Rooms.** For rooms serving multi-functions, such as hotel banquet/meeting rooms and office conference/presentation rooms, a supplementary lighting system with independent controls may be installed. The installed power for the supplementary system shall not be greater than 50% of the base LPB calculated in accordance with Section 3113.5.1.1.
2. **Simultaneous Activities.** In rooms containing multiple simultaneous activities such as a large general office having separate accounting and drafting areas within the same room, the LPB for the rooms shall be the weighted average of the activities in proportion to the areas being served.

3113.5.2 The Interior Lighting Power Limit (ILPL) shall include a 0.20W/ft² allowance for unlisted space areas. The ILPL shall be calculated in accordance with equation 3113.5.2.

Equation 3113.5.2:

$$\text{ILPL} = \text{LPB (Listed Spaces)} + 0.20\text{W/ft}^2 \times (\text{Unlisted Space})$$

where:

ILPL = Interior Lighting Power Limit

Unlisted space = (LBA - Area of listed spaces), ft²

LBA = Lighting Building Area, ft²

LPB = Lighting Power Budget

3113.5.3 Compliance: A building shall be considered in compliance with this section if the interior Adjusted Lighting Power (ALP) to be installed in the building, as determined in 3113.3.1, does not exceed the Interior Lighting Power Limit (ILPL) for the building, as determined in 3113.5.2.

TABLE 3113.5.1
BASE UNIT POWER DENSITY (UPD FOR AREA/ACTIVITY-W/FT²)

AREA/ACTIVITY	UPD	NOTE
COMMON ACTIVITY AREAS		
Auditorium	1.6	(a)
Corridor	0.9	(b)
Classroom/Lecture hall	2.0	
Elec/Mech equipment room		
General	0.7	(b)
Control rooms	1.5	(b)
Food Service		
Fast food/Cafeteria	1.3	
Leisure dining	2.5	
Bar/Lounge	2.5	(c)
Kitchen	1.4	(c)
Recreation/lounge	0.7	
Stair		
Active traffic	0.6	
Emergency exit	0.4	
Toilet & Washroom	0.8	
Garage		
Auto & Pedestrian		
Circulation	0.3	
Parking area	0.2	
Laboratory	2.3	
OFFICE CATEGORY 1		
Enclosed offices, all open plan offices without partitions or with partitions lower than 4.5 ft. below the ceiling		d
Reading, typing and filing	1.6	e
Drafting	2.5	e
Accounting	2.0	e
OFFICE CATEGORY 2		
Open plan offices 900 square feet or larger with partitions 3.5 to 4.5 feet below the ceiling. (Offices less than 900 square feet shall use Category 1)		(d)

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TABLE 3113.5.1 (continued)
BASE UNIT POWER DENSITY (UPD FOR AREA/ACTIVITY-W/FT²)

AREA/ACTIVITY	UPD	NOTE
Reading, typing and filing	1.9	b
Drafting	2.9	b
Accounting	2.4	b
OFFICE CATEGORY 3 Open plan offices 900 square feet or larger with partitions higher than 3.5 feet below the ceiling. (Offices less than 900 square feet shall use Category 1)		d
Reading, typing and filing	2.1	(b)
Drafting	3.4	(b)
Accounting	2.7	(b)
COMMON ACTIVITY AREAS		
Library		
Audio visual	1.1	
Stack area	1.5	
Card file and cataloging	1.6	
Reading area	1.9	
Lobby (General)		
Reception and waiting	1.0	
Elevator lobbies	0.8	
Atrium (multi-story)		
First 3 floors	0.7	
Each additional floor	0.2	
Locker room and shower	0.8	
Conference/meeting room	1.8	(a)
Computer/office equipment	2.1	
Filing, inactive	1.0	
Mail room	1.8	
Shop (Non-industrial)		
Machiner	2.5	
Electrical/electronic	2.5	
Painting	1.6	
Carpentry	2.3	
Welding	1.2	

TABLE 3113.5.1 (continued)
BASE UNIT POWER DENSITY (UPD FOR AREA/ACTIVITY-W/FT²)

AREA/ACTIVITY	UPD	NOTE
Storage and Warehouse		
Inactive storage	0.3	
Active storage, bulky	0.3	
Active storage, fine	1.0	
Material handling	1.0	
Unlisted space	0.2	
SPECIFIC BUILDINGS		
Airport, Bus and Rail Station		
Baggage area	0.8	
Concourse/Main thruway	0.9	
Ticket counter	2.5	
Waiting and Lounge area	1.2	
Bank		
Customer area	1.0	
Banking activity area	2.8	
Barber and Beauty parlor	2.0	
Church, Synagogue, Chapel		
Worship/Congregational	2.3	
Preaching and Sermon/Choir	2.7	
Dormitory		
Bedroom	1.0	
Bedroom with study	1.2	
Study hall	1.8	
Fire and Police Department		
Fire engine room	0.7	
Jail cell	0.8	

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TABLE 3113.5.1 (continued)
BASE UNIT POWER DENSITY (UPD FOR AREA/ACTIVITY-W/FT²)

AREA/ACTIVITY	UPD	NOTE
Hospital/Nursing Home		
Corridor	1.3	(b)
Dental suite/Exam./Treat	1.6	
Emergency	2.3	
Laboratory	1.9	
Loundg/Waiting room	0.9	
Medical supplies	2.4	
Nursery	2.0	
Nurse station	2.1	
Occu./Physical therapy	1.6	
Patient room	1.4	
Pharmacy	1.7	
Radiology	2.1	
Surgical and O.B. Suites		
Genral area	2.1	
Operating room	7.0	
Recovery	3.0	
Hotel/Conference Center		
Banquet room /Multi-purpose	2.4	(a)
Bathroom/Powder room	1.2	
Guest room	1.4	
Public area	1.1	
Exhibition hall	2.6	
Conference/Meeting	1.8	(a)
Lobby	1.9	
Reception desk	2.4	
Laundry		
Washing	0.9	
Ironing and Sorting	1.3	
Museum and Gallery		
General exhibition	1.9	
Inspect/Restoration	3.9	
Storage (Artifacts)		
Inactive	0.6	
Active	0.7	

TABLE 3113.5.1 (continued)
BASE UNIT POWER DENSITY (UPD FOR AREA/ACTIVITY-W/FT²)

AREA/ACTIVITY	UPD	NOTE
Post Office Lobby Sorting	1.1 2.1	
Service Station/Auto Repair	1.0	
Theater Performance arts Motion picture Lobby	1.5 1.0 1.5	
Retail Establishments (Merchandising and Circulation Area) Applicable to all lighting, including accent and display lighting, installed in merchandising and circulation area		
Type A Type B Type C Type D Type # Mall concourse Retail support areas Tailoring Dressing/Fitting rooms	4.0 3.2 3.0 2.8 2.6 1.4 2.1 1.4	(f) (f) (f) (f) (f)
INDOOR ATHLETIC AREAS		
Seating Area, All Sports	0.4	(g)
Badminton Club Tournament	0.5 0.8	
Basketball/Volleyball Intramural College Professional	0.8 1.3 1.9	
Bowling Approach area Lanes	0.5 1.1	

TABLE 3113.5.1 (continued)
BASE UNIT POWER DENSITY (UPD FOR AREA/ACTIVITY-W/FT²)

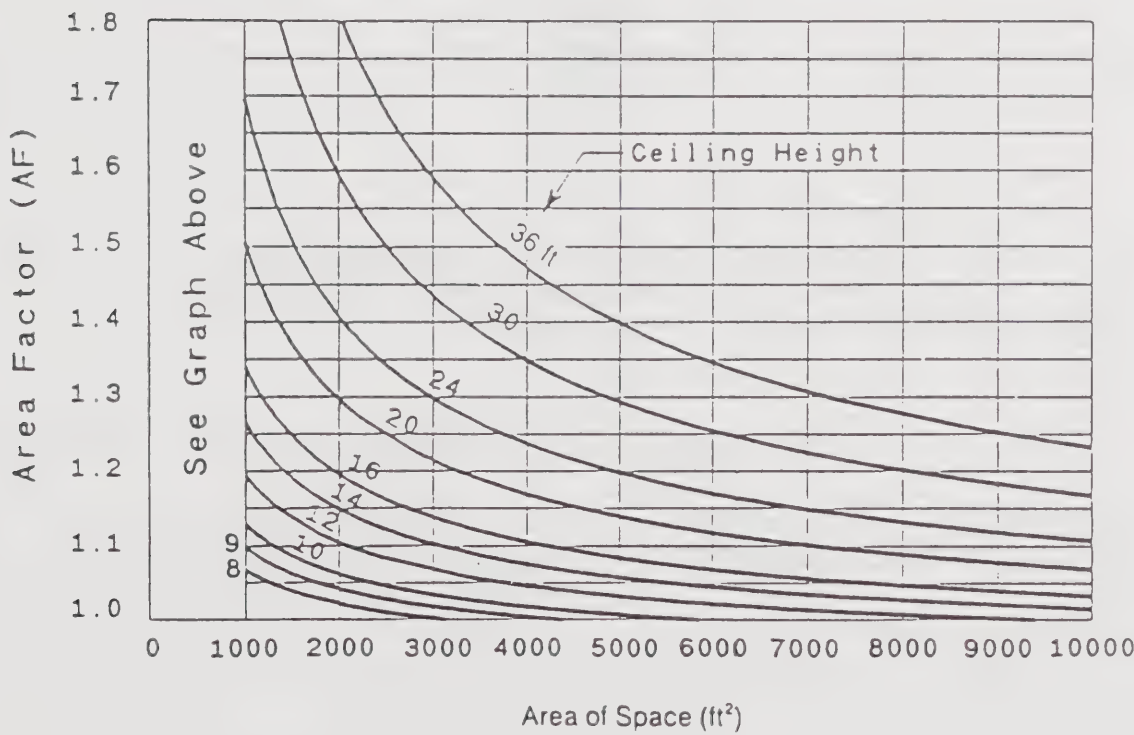
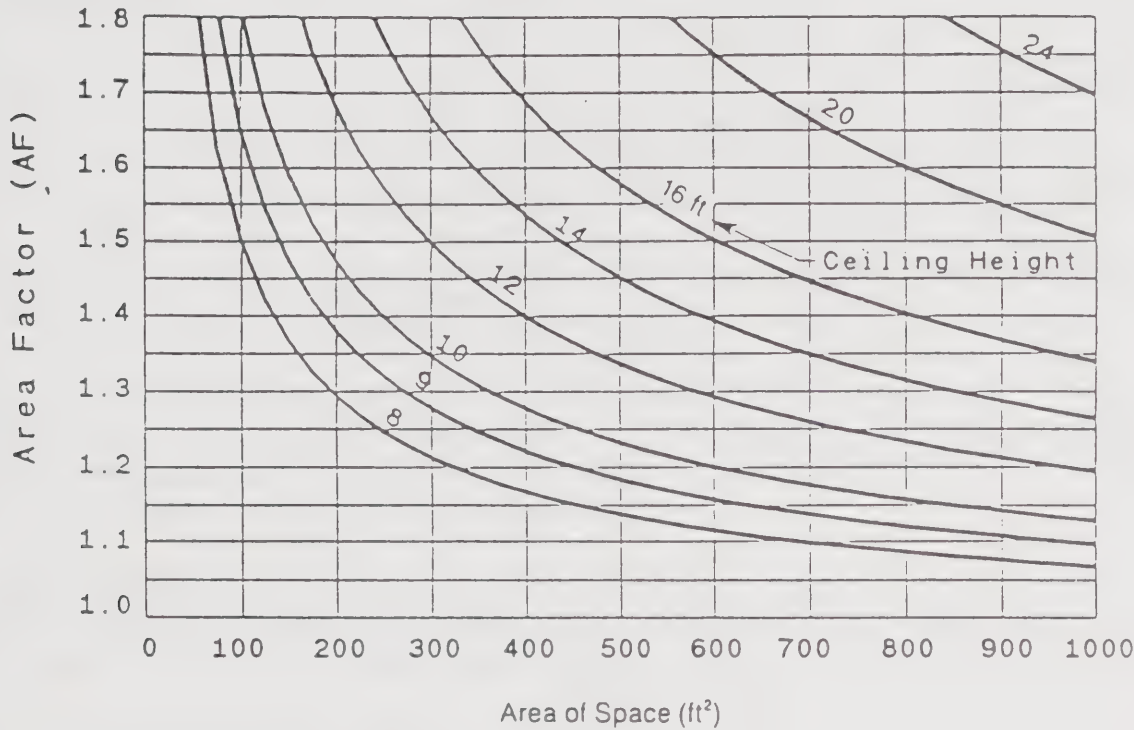
AREA/ACTIVITY	UPD	NOTE
Boxing or Wrestling (platform)		
Amateur	2.4	
Professional	4.8	
Gymnasium		
General exercising and Recreation only	1.0	
Handball/Racquetball/Squash		
Club	1.3	
Tournament	2.6	
Hockey, ice		
Amateur	1.3	
College or Professional	2.7	
Skating Rink		
Recreational	0.6	
Exhibition/Professional	2.7	
Swimming		
Recreational	0.9	
Exhibition	1.5	
Tennis		
Recreational (Class III)	1.3	
Club/College (Class II)	1.9	
Professional (Class I)	2.7	
Tennis, Table		
Club	1.0	
Tournament	1.6	

Notes:

- (a) A 1.5 adjustment factor is applicable for multi-functional spaces.
- (b) Area Factor of 1.0 shall be used for these spaces.
- (c) Base UPD includes lighting power required for clean-up purpose.
- (d) Not less than 90% of all work stations shall be individually enclosed with partitions of at least the height described.
- (e) Area Factor shall not exceed 1.55.
- (f) See Article 2 for definitions of Retail Facilities.
- (g) Area Factor of 1.0 shall be used for all indoor athletic spaces.

FIGURE 3113.5.1
AREA FACTOR ADJUSTMENTS

THESE TWO FIGURES GO HERE (EXTRACTED FROM ASHRAE STANDARD 90.1 AND THE SAME AS THE FIGURES FOUND IN FOURTH EDITION)



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SECTION 3114.0 BUILDING ENVELOPE REQUIREMENTS FOR COMMERCIAL AND HIGH RISE RESIDENTIAL BUILDINGS

3114.1 Scope: This section applies to commercial buildings and to high rise residential buildings over three (3) stories.

3114.2 Compliance: The envelope design of a building being evaluated is on compliance with the requirements of this section provided that:

1. The minimum requirements and calculation procedures of Section 3114.3 are met; and,
2. Compliance with either the prescriptive criteria (3114.4) or the system performance criteria (3114.5) is met.

3114.2.1 The prescriptive criteria (3114.4) provide a simple calculation procedure with limited flexibility. The system performance criteria (3114.5) provide a more complex and lengthy calculation procedure with greater flexibility usually suitable for complex envelope assemblies in larger buildings.

When using the system performance criteria (3114.5) a computer-based procedure, approved by the State Board of Building Regulations and Standards, may be used to calculate the exterior envelope compliance values.

3114.3 Minimum Requirements

3114.3.1 Overall thermal transmittance (U_o): The overall thermal transmittance of building envelope assemblies shall be calculated in accordance with Equation 3114.3.1:

$$U_o = (U_i A_i + \dots + U_n A_n) / A_o \quad \text{Equation 3114.3.1}$$

where:

U_o = the average thermal transmittance of the gross area of an envelope assembly, e.g., the exterior wall assembly, including fenestration and doors; roof and/or ceiling assembly; or floor assembly, (Btu/h-ft²-°F).

A_o = the gross area of the envelope assembly, (ft²).

U_i = the thermal transmittance of each individual element of the envelope assembly, e.g., the opaque portion of the wall or the fenestration - see section 3114.3.2, (Btu/h-ft²-°F).

U_t = $1/R_t$, the total resistance of the envelope assembly, (Btu/h-ft²-°F).

A_i = the area of each individual element of the envelope assembly, (ft²).

3114.3.2 Thermal transmittance (U_i) of an individual element of an envelope assembly: The thermal transmittance of each envelope assembly shall be determined accounting for all series and parallel heat flow paths through the elements of the assembly. Compression of insulation shall be accounted for in determining the thermal resistance.

3114.3.2.1 The thermal transmittance of opaque elements of assemblies shall be determined using a series path procedure with correction for the presence of parallel paths within an element of the envelope assembly (such as parallel paths through wall cavities with insulation and studs). The procedure to be used in meeting the requirements of this section is given in Appendix E.

3114.3.2.2 The thermal transmittance of fenestration assemblies shall be corrected to account for the presence of sash, frames, edge effects and spacers in multiple glazed units. If thermal transmittances of sash and frames are known, then Equation 3114.3.1 shall be used for calculation, otherwise Equation 3114.3.2 shall be used:

Equation 3114.3.2

$$U_{of} = \frac{(U_{g,1} \cdot F_{f,1} \cdot A_1 + U_{g,2} \cdot F_{f,2} \cdot A_2 + \dots + U_{g,n} \cdot F_{f,n} \cdot A_n)}{A_{of}}$$

Where:

U_{of} = the overall thermal transmittance of the fenestration assemblies, including sash and frames, (Btu/h-ft²-°F).

U_g = the thermal transmittance of the central area of the fenestration excluding edge effects, spacers in multiple-glazed units, and the sash and frame, (Btu/h-ft²-°F).

F_f = framing adjustment factor for sash, frames, etc.

A_{of} = the area all fenestration including glazed portions, sash, frames, etc., (ft²).

Values for U_g shall be the larger of the winter or summer values obtained from Figure 14, Chapter 27 of the ASHRAE Handbook, 1985 Fundamentals Volume. Values for F_f shall be obtained from Table 13, Part C, in Chapter 27, of the ASHRAE Handbook, 1985 Fundamentals Volume. Values for U_g and F_f may also be obtained from manufacturer's test data for specific product assemblies. Where a

range of framing adjustment factors is provided, the average of the range shall be used.

3114.3.3 Shading coefficients: The Shading Coefficient (SC) for fenestration shall be obtained from Chapter 27 of the ASHRAE Handbook, 1985 Fundamentals Volume or from manufacturers' test data. For the prescriptive or systems performance envelope compliance calculations in Sections 3114.4 and 3114.5 a factor, SC_x, is used. SC_x is the Shading Coefficient of the fenestration, including internal and external shading devices, but excluding the effect of external shading projections which is calculated separately. The shading coefficient used for louvered shade screens shall be determined using a profile angle of 30°, as found in Table 41, Chapter 27 of the ASHRAE Handbook, 1985 Fundamentals Volume.

3114.3.4 Shell buildings: If determination of building envelope compliance occurs prior to the determination of lighting power density, equipment power density, or fenestration shading device characteristics, then the following conditions shall be assumed when determining building envelope compliance by either the prescriptive method of Section 3114.4 or the systems performance method of Section 3114.5.

1. **Lighting Power Density and Equipment Power Density:** For Section 3114.4 the total power density shall be assumed to be those listed in Table 3114.3.4. For section 3114.5, the values in Table 3114.3.4 shall be apportioned as 2/3 lighting and 1/3 for other equipment. Note that these are not recommended design values, but are for compliance purposes only.
2. **Fenestration shading devices:** Only those shading devices that are part of the design when it is being evaluated for compliance shall be considered when determining compliance.
3. **Electric lighting controls for perimeter daylighting utilization:** Only those controls that are part of the design when it is being evaluated for compliance shall be considered when determining compliance.

TABLE 3114.3.4
ASSUMED COMBINED LIGHTING AND EQUIPMENT POWER DENSITIES
FOR SHELL BUILDINGS

LIGHTING CONTROL TYPE	FOR $3000 < \text{HDD}_{65} < 6000$	FOR $\text{HDD}_{65} > 6000$
With automatic lighting controls provided for the perimeter area to be daylighted	1.75 W/ft ²	1.50 W/ft ²
All other lighting controls	2.25 W/ft ²	1.50 W/ft ²

3114.4 Prescriptive criteria

3114.4.1 Purpose: This section provides precalculated prescriptive requirements for selected exterior envelope configurations of new buildings. There are four different sets of precalculated design parameters, including a base case and buildings designed with perimeter daylighting, with high performance glazing with perimeter daylighting or with increased wall thermal mass. Any one set of parameters will achieve compliance.

The Alternate Component Packages (ACP) provide design criteria for the following:

1. "Base Case Buildings" - buildings with envelopes designed without perimeter daylighting.
2. "Perimeter Daylighting Buildings" - buildings which are allotted additional fenestration area due to the incorporation of automatic electric lighting controls for daylight utilization in the perimeter zones.

Note: This daylighting credit is for thermal benefits of daylighting controls on the electric lighting system. This is in addition to the credit provided in Section 3113 for the reduction in lighting energy.

3114.4.2 Compliance: The basic requirements and procedures of Section 3114.3 shall be used with this section. The systems performance criteria in Section 3114.5 may be used instead of this section.

The envelope design of the building being evaluated is in compliance with the prescriptive criteria of this section provided that:

1. The minimum requirements and calculation procedures of Section 3114. are met.
2. All U values are less than or equal to those chosen from the ACP Table selected.

3. All R values are greater than or equal to those listed in the ACP Table for walls below grade and for slab-on-grade floors.
4. The percentage of fenestration relative to the gross external wall area is less than or equal to the value chosen from the ACP Table.

Exception: Portions of external envelopes enclosing atria are not covered by the envelope criteria of this section if the atria are unconditioned and are thermally isolated from conditioned spaces.

3114.4.3 Procedure for using the alternate component package (ACP): The prescriptive envelope criteria are contained in Tables 3114.4.1 through 3114.4.3.

The following steps shall be used to determine compliance with these prescriptive envelope criteria:

3114.4.3.1 Determine appropriate ACP Table: Based upon the heating degree days (base 50), choose the appropriate ACP Table from one of the three ACP Tables found on the following pages.

TABLE 3114.4.1
ALTERNATE COMPONENT PACKAGES FOR
HDD (base 50) 1751 - 2600

INTERNAL LOAD RANGE	PROJECTION FACTOR (PF)	U _{of}	BASE CASE			PERIMETER DAYLIGHTING			THERMAL MASS ADJUSTMENT FOR OPAQUE WALLS				
			0.68 to 0.46	0.45 to 0.39	0.38 to 0.0	0.68 to 0.46	0.45 to 0.39	0.38 to 0.0	U _{ow} (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
0.00 - 1.50	0.000 - 0.249	1.000 - 0.71	21	24	24	22	26	27					
		0.709 - 0.60	25	28	30	26	31	32					
		0.599 - 0.50	28	33	34	29	35	37					
0.250 - 0.499	0.249	0.499 - 0.38	31	38	40	32	40	43					
		0.379 - 0.25	35	46	50	36	48	53					
		0.249 - 0.0	41	58	65	42	59	68					
0.500	0.500	1.000 - 0.71	26	30	32	27	33	34					
		0.709 - 0.60	30	36	38	31	38	41					
		0.599 - 0.50	33	41	44	34	43	47					
1.51 - 3.00	0.00 - 0.249	0.499 - 0.38	36	46	50	36	48	53					
		0.379 - 0.25	40	54	60	40	56	63					
		0.249 - 0.00	31	37	40	32	40	43					
1.51 - 3.00	0.250 - 0.499	1.000 - 0.71	34	44	47	35	46	51					
		0.709 - 0.60	37	49	53	38	51	57					
		0.599 - 0.50	40	54	60	40	56	63					
1.51 - 3.00	0.500	0.499 - 0.38	17	18	18	21	24	25					
		0.379 - 0.25	20	22	22	25	29	31					
		0.249 - 0.00	22	25	26	27	33	36					
1.51 - 3.00	0.000 - 0.249	1.000 - 0.71	25	30	31	30	38	42					
		0.709 - 0.60	30	37	39	35	45	51					
		0.599 - 0.50	37	49	54	41	57	67					
1.51 - 3.00	0.250 - 0.499	0.499 - 0.38	21	23	24	26	31	33					
		0.379 - 0.25	24	28	29	29	36	40					
		0.249 - 0.00	27	32	34	32	41	45					
1.51 - 3.00	0.500	1.000 - 0.71	30	37	40	35	46	52					
		0.709 - 0.60	35	45	49	39	53	62					
		0.599 - 0.50	25	29	30	30	37	41					
1.51 - 3.00	0.000 - 0.249	0.499 - 0.38	29	35	37	34	43	49					
		0.379 - 0.25	32	39	42	36	48	55					
		0.249 - 0.00	35	45	48	39	53	62					

3.01 - 3.50	0.000 - 0.249	1.000 - 0.71 0.709 - 0.60 0.599 - 0.50 0.499 - 0.38 0.379 - 0.25 0.249 - 0.00	15 17 20 23 27 34	16 19 22 26 33 44	16 20 23 27 35 48	20 24 26 29 34 39	23 28 32 36 44 55	25 30 35 41 50 65	U _{ow} (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
3.01 - 3.50	0.250 - 0.499	1.000 - 0.71 0.709 - 0.60 0.599 - 0.50 0.499 - 0.38 0.379 - 0.25	18	20	21	25	29	32	0.096	HC ≥ 5	15	0.10	0.14
			22	25	25	28	35	39		HC ≥ 10	15	0.12	0.17
			24	28	30	31	39	44		HC ≥ 15	15	0.14	0.19
0.500		1.000 - 0.71 0.709 - 0.60 0.599 - 0.50 0.499 - 0.38	27	33	35	34	44	51		HC ≥ 5	65	0.10	0.12
			32	40	43	38	51	61		HC ≥ 10	65	0.11	0.14
										HC ≥ 15	65	0.12	0.15

VT ≥ SC

Daylight
Sensing
Controls

LOCATION	MINIMUM R-VALUE	LOCATION	MINIMUM U _o
Wall Below Grade:	8	Roof:	0.060
Unheated Slab on Grade: Horizontal	24" 36" 48" 15 13 10	Wall Adjacent to Unconditioned Space:	0.16
Vertical	7 5 4	Floor Over Unconditioned Space:	0.060

TABLE 3114.4.2
ALTERNATE COMPONENT PACKAGES FOR
HDD (base 50) 2601 - 3200

INTERNAL LOAD RANGE	PROJECTION FACTOR (PF)	Uof SHADING COEFF RANGE	BASE CASE				PERIMETER DAYLIGHTING				THERMAL MASS ADJUSTMENT FOR OPAQUE WALLS				
			0.68 to 0.46	0.45 to 0.39	0.38 to 0.0		0.68 to 0.46	0.45 to 0.39	0.38 to 0.0						
0.00 - 1.50	0.000 - 0.249	1.000 - 0.71	21	25	26		22	26	27		Uow (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
		0.709 - 0.60	24	29	31		25	31	33						
		0.599 - 0.50	26	33	35		27	34	37						
	0.250 - 0.499	0.499 - 0.38	29	37	40		29	38	42		0.085	HC ≥ 5 HC ≥ 10 HC ≥ 15	21 21 21	0.096 0.098 0.10	0.11 0.12 0.13
		0.379 - 0.25	32	43	48		32	44	50						
		0.249 - 0.0	35	52	60		35	52	60						
1.51 - 3.00	0.00 - 0.249	1.000 - 0.71	25	31	33		26	32	35		Uow (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
		0.709 - 0.60	28	36	39		28	37	41						
		0.599 - 0.50	30	40	44		30	41	46						
	0.250 - 0.499	0.499 - 0.38	32	44	49		32	45	51		0.085	HC ≥ 5 HC ≥ 10 HC ≥ 15	60 60 60	0.089 0.095 0.099	0.10 0.11 0.11
		0.379 - 0.25	35	50	57		34	50	58						
		0.249 - 0.00	29	37	40		29	39	43						
1.51 - 3.00	0.00 - 0.249	1.000 - 0.71	17	19	20		21	24	26		Uow (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
		0.709 - 0.60	20	23	24		24	29	31						
		0.599 - 0.50	22	26	28		26	32	36						
	0.250 - 0.499	0.499 - 0.38	25	30	32		28	36	41		0.085	HC ≥ 5 HC ≥ 10 HC ≥ 15	17 17 17	0.092 0.10 0.11	0.12 0.13 0.14
		0.379 - 0.25	28	37	40		31	42	49						
		0.249 - 0.00	33	46	52		35	51	60						
1.51 - 3.00	0.00 - 0.249	1.000 - 0.71	21	24	25		25	31	33		Uow (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
		0.709 - 0.60	24	29	31		27	35	39						
		0.599 - 0.50	26	33	35		29	39	44						
	0.250 - 0.499	0.499 - 0.38	29	37	40		31	43	49		0.085	HC ≥ 5 HC ≥ 10 HC ≥ 15	60 60 60	0.091 0.098 0.10	0.10 0.12 0.12
		0.379 - 0.25	32	43	48		34	48	56						
		0.249 - 0.00	25	30	32		28	36	41						
1.51 - 3.00	0.00 - 0.249	1.000 - 0.71	25	30	32		30	41	47		Uow (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
		0.709 - 0.60	27	35	38		32	45	52						
		0.599 - 0.50	30	39	42		34	48	57						
	0.250 - 0.499	0.499 - 0.38	32	43	48		36	50	58		0.085	HC ≥ 5 HC ≥ 10 HC ≥ 15	60 60 60	0.091 0.098 0.10	0.10 0.12 0.12
		0.379 - 0.25	35	50	57		39	53	60						
		0.249 - 0.00	29	37	40		31	47	53						

3.01 - 3.50	0.000 - 0.249	1.000 - 0.71	15	17	17	20	24	26	U _{ow} (HC<5)	HC ≥ 5 HC ≥ 10 HC ≥ 15	PCT FEN	INT INS	EXT INS
		0.709 - 0.60	18	20	21	23	28	31					
		0.599 - 0.50	20	23	25	25	32	35					
	0.250 - 0.499	0.499 - 0.38	23	27	29	27	35	40	0.085	HC ≥ 5 HC ≥ 10 HC ≥ 15	59 59 59	0.092 0.10 0.11	0.12 0.14 0.15
		0.379 - 0.25	26	33	36	30	41	48					
		0.249 - 0.00	31	42	47	34	50	59					
	0.500	1.000 - 0.71	19	22	22	24	30	33	VT ≥ SC	HC ≥ 5 HC ≥ 10 HC ≥ 15	59 59 59	0.090 0.097 0.10	0.10 0.12 0.12
		0.709 - 0.60	22	26	27	26	34	39					
		0.599 - 0.50	24	29	31	28	38	43					
		0.499 - 0.38	26	33	36	30	42	48	Daylight Sensing Controls	HC ≥ 5 HC ≥ 10 HC ≥ 15	59 59 59	0.090 0.097 0.10	0.10 0.12 0.12
0.379 - 0.25		30	39	43	33	47	56						
1.000 - 0.71		22	27	28	27	35	40						
	0.709 - 0.60	25	31	33	29	40	46	VT ≥ SC	HC ≥ 5 HC ≥ 10 HC ≥ 15	59 59 59	0.090 0.097 0.10	0.10 0.12 0.12	
	0.599 - 0.50	27	35	38	31	43	51						
	0.499 - 0.38	30	39	43	33	47	56						

LOCATION	MINIMUM U _o
Roof:	0.056
Wall Adjacent to Unconditioned Space:	0.14
Floor Over Unconditioned Space:	0.051

LOCATION	MINIMUM R-VALUE
Wall Below Grade:	9
Unheated Slab on Grade:	24" 36" 48"
Horizontal	16 13 10
Vertical	7 6 4

TABLE 3114.4.3
ALTERNATE COMPONENT PACKAGES FOR
HDD (base 50) 3201 - 4000

INTERNAL LOAD RANGE	PROJECTION FACTOR (PF)	Uof	BASE CASE			PERIMETER DAYLIGHTING			THERMAL MASS ADJUSTMENT FOR OPAQUE WALLS				
			0.68 to 0.46	0.45 to 0.39	0.38 to 0.0	0.68 to 0.46	0.45 to 0.39	0.38 to 0.0	Uow (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
0.00 - 1.50	0.000 - 0.249	1.000 - 0.71	20	25	26	20	26	27	0.077	HC ≥ 5	20	0.080	0.099
		0.709 - 0.60	22	29	31	22	29	32		HC ≥ 10	20	0.087	0.11
		0.599 - 0.50	24	32	35	23	33	36		HC ≥ 15	20	0.092	0.11
	0.250 - 0.499	0.499 - 0.38	25	35	39	25	35	39		HC ≥ 5	52	0.080	0.095
		0.379 - 0.25	27	39	45	26	38	44		HC ≥ 10	52	0.085	0.10
		0.249 - 0.0	28	44	52	28	43	51		HC ≥ 15	52	0.089	0.10
	0.500	1.000 - 0.71	23	31	33	23	31	34		HC ≥ 5	52	0.080	0.095
		0.709 - 0.60	25	34	38	25	34	39		HC ≥ 10	52	0.085	0.10
		0.599 - 0.50	26	37	42	25	37	42		HC ≥ 15	52	0.089	0.10
		0.499 - 0.38	27	40	46	26	39	45		HC ≥ 5	52	0.080	0.095
		0.379 - 0.25	28	43	51	27	42	49		HC ≥ 10	52	0.085	0.10
		1.000 - 0.71	26	36	40	25	36	41		HC ≥ 15	52	0.089	0.10
		0.709 - 0.60	27	39	44	26	39	45		HC ≥ 5	52	0.080	0.095
		0.599 - 0.50	28	41	48	27	41	47		HC ≥ 10	52	0.085	0.10
		0.499 - 0.38	28	43	51	28	42	50		HC ≥ 15	52	0.089	0.10
1.51 - 3.00	0.00 - 0.249	1.000 - 0.71	17	20	21	20	24	26	0.077	HC ≥ 5	17	0.081	0.10
		0.709 - 0.60	19	24	25	22	28	31		HC ≥ 10	17	0.089	0.12
		0.599 - 0.50	21	27	29	23	31	34		HC ≥ 15	17	0.096	0.12
	0.250 - 0.499	0.499 - 0.38	23	30	33	25	34	38		HC ≥ 5	51	0.080	0.096
		0.379 - 0.25	26	35	39	27	38	44		HC ≥ 10	51	0.085	0.10
		0.249 - 0.0	29	42	48	29	43	49		HC ≥ 15	51	0.089	0.11
	0.500	1.000 - 0.71	20	25	27	22	29	33		HC ≥ 5	51	0.080	0.096
		0.709 - 0.60	23	29	31	24	33	37		HC ≥ 10	51	0.085	0.10
		0.599 - 0.50	24	32	35	25	36	41		HC ≥ 15	51	0.089	0.11
		0.499 - 0.38	26	35	39	27	38	44		HC ≥ 5	51	0.080	0.096
		0.379 - 0.25	28	40	45	28	42	49		HC ≥ 10	51	0.085	0.10
		1.000 - 0.71	23	30	32	25	34	39		HC ≥ 15	51	0.089	0.11
		0.709 - 0.60	25	34	37	26	37	43		HC ≥ 5	51	0.080	0.096
		0.599 - 0.50	27	37	41	27	39	46		HC ≥ 10	51	0.085	0.10
		0.499 - 0.38	28	40	45	28	42	49		HC ≥ 15	51	0.089	0.11

3.01 - 3.50	0.000 - 0.249	1.000 - 0.71 0.709 - 0.60 0.599 - 0.50 0.499 - 0.38 0.379 - 0.25 0.249 - 0.00	16	18	19	19	24	26	26	U _{ow} (HC<5)	HC RANGE	PCT FEN	INT INS	EXT INS
			18	21	22	21	27	30	34					
3.01 - 3.50	0.250 - 0.499	1.000 - 0.71 0.709 - 0.60 0.599 - 0.50 0.499 - 0.38 0.379 - 0.25	19	23	24	22	29	32	37	0.077	HC ≥ 5	16	0.081	0.10
			21	26	28	24	32	37	41		HC ≥ 10	16	0.090	0.12
			23	29	32	25	35	41	44		HC ≥ 15	16	0.098	0.13
0.500	1.000 - 0.71 0.709 - 0.60 0.599 - 0.50 0.499 - 0.38	0.379 - 0.25	24	33	36	26	38	44	49	0.077	HC ≥ 5	51	0.080	0.097
			27	37	42	28	41	49	51		HC ≥ 10	51	0.086	0.10
			22	27	29	24	33	39	43		HC ≥ 15	51	0.090	0.11
VT ≥ SC														
Daylight Sensing Controls														

LOCATION	MINIMUM R-VALUE	LOCATION	MINIMUM U _o
Wall Below Grade:	10	Roof:	0.052
Unheated Slab on Grade:	24" 36" 48"	Wall Adjacent to Unconditioned Space:	0.13
Horizontal	17 14 11	Floor Over Unconditioned Space:	0.045
Vertical	8 6 4		

3114.4.3.2 Determine the Maximum Allowable Percent Fenestration: Using the appropriate ACP Table as determined in 3114.4.3.1, determine the maximum allowable percent fenestration. The maximum allowable percent fenestration is the total area of fenestration assemblies divided by the total gross external wall area, considering all elevations of the building. Determining the maximum allowable percent fenestration requires the following five steps:

STEP 1. Based on the Internal Load Density (ILD) for the design building, select one of the three Internal Load Ranges as the point of entry to the tables. Note: for ILD's greater than 3.5 Watts per ft², use the 3.5 Watts per ft² range. Determine the Internal Load Density (ILD) of the design building, based on the sum of the Internal Lighting Power Allowance (ILPA), the Equipment Power Density (EPD) and the Occupant Load Adjustment (OLA), as shown in Equation 3114.4.3.2.1.

$$ILD = ILPA + EPD + OLA \quad \text{Equation 3114.4.3.2.1}$$

Where:

The Internal Lighting Power Allowance (ILPA) shall be either:

1. The building average Internal Lighting Power Allowance (ILPA) of the design building in W/ft² as determined from Section 3113.4 (for dwelling units within high rise residential buildings the limit is 0.0 W/ft²); or
2. The average of the Lighting Power Budgets (LPB) for all activity areas within 15 feet of each exterior wall based on the procedures specified by the Systems Performance Criteria of Section 3113.5.

The Equipment Power Density (EPD) shall be either:

1. The building average receptacle power density selected from Table 3114.4.4 is W/ft²; or
2. The actual average receptacle power density for all activity areas within 15 feet of each exterior wall in W/ft², considering diversity. For determining compliance in Tables 3114.4.1 through 3114.4.3, the actual average receptacle power densities calculated by this method that exceed 1.0 W/ft² shall be limited to 1.0 W/ft².

**TABLE 3114.4.4
AVERAGE RECEPTACLE POWER DENSITIES**

BUILDING TYPE	WATTS/FT ²
1. Assembly	0.25
2. Office	0.75
3. Retail	0.25
4. Warehouse	0.1
5. School	0.5
6. Hotel/Motel	0.25
7. Restaurant	0.1
8. Health	1.0
9. Multi-family	0.75

The Occupant Load Adjustment (OLA) shall be either:

1. 0.0 W/ft²: this recognizes the assumed occupant sensible load of 0.6 W/ft² that is built into the ACP tables; or
2. A positive or negative difference between the actual occupant load and 0.6 W/ft² if the design building has a larger or smaller occupant load.

STEP 2. Select external shading projection factor (PF). If no external shading projections are used in the proposed design, select the **row/column** designated Proj. Factor = 0.0 If external shading projections are used, determine the average projection factor on window area weighted basis. Then select the appropriate column in the ACP Table using Equation 3114.4.3.2.2.

$$PF = Pd / H \quad \text{Equation 3114.4.3.2.2}$$

Where:

PF = External shading projection factor

Pd = External shading projection depth, inches or feet

H = Sum of height of the fenestration and the distance from the top of the fenestration to the bottom of external shading projection in units consistent with Pd.

STEP 3. Select the Shading Coefficient of the fenestration (SCx) including internal, integral and external shading devices, but excluding the effect of external shading projections (PF). Note: This includes curtains, shades, or blinds. Reference ASHRAE Handbook, 1985 Fundamentals, Chapter 27.

STEP 4. Select one of the daylighting options, either:

1. Base Case, no daylighting
2. Perimeter Daylighting (automatic daylight controls for lighting system must be used).

STEP 5. Select appropriate fenestration type. For most options, this is determined by the thermal transmittance value (Uof) of the fenestration assemble. For the high performance fenestration options (the far right column of each case), the visible transmittance (VT) of the fenestration should not be less than the shading coefficient of the glazed portion of the fenestration assemble, not considering any shading devices. The ranges correspond to double glazing, triple glazing, and high performance glazing.

3114.4.3.3 Determine the Maximum Uow for the Opaque Wall Assembly: In the appropriate ACP Table the Maximum Uow for the opaque wall assembly is determined using the applicable following steps (Note that if the wall has a heat capacity of 5 BTU/ft²-°F or greater, the "thermal mass adjustment" calculations discussed in item 2 below, allow for the development of a relaxed value for Uow):

1. For a lightweight wall assembly; i.e., a wall with a heat capacity (HC) less than 5 BTU/ft²-°F, use the value indicated under the ACP Table column labelled Uow (HC<5). This Uow is constant over all internal load ranges.

or

2. To use the mass wall adjustment (only for walls with heat capacities of 5 BTU/ft²-°F or greater), the following two additional steps are necessary:
 1. Select the same internal load range as that used in determining the maximum allowable percent fenestration.
 2. Select the mass wall heat capacity (HC) and insulation position. If the wall insulation is positioned internal to or integral with the wall mass, use the column headed Interior/Integral Insulation. If the wall insulation is positioned external to the wall mass, use the

column headed Exterior Insulation. For HC less than 5 BTU/ft². °F, this adjustment table cannot be used.

3. Select or interpolate for the appropriate maximum U_{ow} for the opaque wall based on the maximum allowable percent fenestration determined in Section 3114.4.3.1 or the actual building percent fenestration whichever value is lower. The U_{ow} shall be determined by straight line interpolation for fenestration percentages between the smallest and largest values listed. If the design building percentage fenestration is less than the smallest value listed, select the U_{ow} for the smallest percentage fenestration listed. If the design building percentage fenestration is greater than the largest value listed, select the U_{ow} for the largest percentage fenestration listed.

3114.4.3.4 Determine Other Envelope Criteria: In each ACP table, the criteria for roof, wall adjacent to unconditioned space, wall below grade, floor over unconditioned space, and slab-on-grade floors shall be met. For heated slabs-on-grade, the R-value shall be the R-value for slab-on-grade plus R-2.0.

3114.5 Systems performance criteria

3114.5.1 Purpose: This section provides a systems approach to envelope compliance.

3114.5.2 Compliance: The basic requirements and procedures of Section 3114.3 shall be used with this section. The prescriptive envelope criteria in Section 3114.4 may be used instead of this section.

Note that portions of external envelopes enclosing atria are not covered by the envelope criteria of this section if the atria are unconditioned and are thermally isolated from conditioned spaces.

NOTE 1: A COMPUTER SOFTWARE PROGRAM, *ENVSTD* (ENVELOPE STANDARD) IS REQUIRED TO PERFORM SECTION 3114.5 EVALUATION (Certain data is only available in the libraries of the computer software program and are not found within the printed Building Code).

THE *ENVSTD* SOFTWARE PROGRAM, ALONG WITH THE *LTGSTD* SOFTWARE PROGRAM (SEE SECTION 3113.5) ARE COMBINED ON A SINGLE 5 1/4 " FLOPPY DISC AND THIS DISC, PLUS A USER'S MANUAL FOR BOTH PROGRAMS, ARE AVAILABLE THROUGH THE STATE BOOKSTORE (617) 727-2834.

NOTE 2: THE INFORMATION PROVIDED IN SECTIONS 3114.5.3 THROUGH 3114.5.8.6 IS ONLY PRESENTED TO PROVIDE THE READER WITH AN OVERVIEW OF ANALYSIS TECHNIQUES EMPLOYED BY THE *ENVSTD* PROGRAM, AND SHOULD NOT BE UTILIZED TO PERFORM ANALYSIS BY HAND - THE *ENVSTD* PROGRAM MUST BE USED FOR ANALYSIS UNDER SECTION 3114.5 (THIS PROGRAM PERFORMS PASS/FAIL ANALYSIS).

3114.5.3 Roof thermal transmittance requirements: Any building that is heated and/or mechanically cooled shall have an overall thermal transmittance value (U_{or}) for the gross area of the roof assembly less than or equal to the value determined by Equation 3114.5.3. The provisions of Section 3114.3 shall be followed in determining acceptable combinations of materials that will meet the required U_{or} values of Equation 3114.5.3.

Equation 3114.5.3

$$U_{or} = 1/(5.3 + 1.8 \times 10^{-3} \times HDD65 + 1.3 \times 10^{-3} \times CDD65 + 2.6 \times 10^{-4} \times CDH80)$$

3114.5.3.1 Skylights for which daylight credit is taken may be excluded from the calculation of the overall thermal transmittance value (U_{or}) of the roof assembly, if all of the following conditions are met:

1. The opaque roof thermal transmittance U_{or} value does not exceed the values determined by Equation 3114.5.3.
2. The overall thermal transmittance of the skylight assembly, including framing, shall be less than or equal to 0.7 Btu/h-ft²-°F.
3. Skylight areas, including framing, as a percentage of the roof area do not exceed the values specified in Tables 3114.5.3.1a and 3114.5.3.1b, where Visible Transmittance (VT) is the transmittance of a particular glazing material over the visible portion of the solar spectrum. (Skylight areas shall only be interpolated between visible transmittance values of 0.75 and 0.50).
4. The skylight area for which daylight credit can be taken is the area under each skylight whose dimension in each direction (centered on the skylight) is equal to the skylight dimension in that direction plus the floor to ceiling height.
5. Skylight areas that have already taken daylight credit (perimeter window areas or other skylight areas) cannot again take daylight credit.

6. All electric lighting fixtures within skylight areas shall be controlled by automatic daylighting controls.
7. Skylight curbs shall have thermal transmittance U values less than or equal to 0.21 Btu/hr-ft²-°F.
8. The infiltration coefficient of the skylights shall be less than or equal to 0.05 cfm/ft².

TABLE 3114.5.3.1a
MAXIMUM PERCENT SKYLIGHT AREA (VT = 0.75)

LIGHT LEVEL IN fc	RANGE OF LIGHTING POWER DENSITY, W/ft ²			
	< 1.0	1.1 - 1.5	1.6 - 2.0	> 2.0
30	2.3	3.4	4.5	5.6
50	2.5	4.0	5.5	7.0
70	2.8	4.6	6.4	8.2

TABLE 3114.5.3.1b
MAXIMUM PERCENT SKYLIGHT AREA (VT = 0.50)

LIGHT LEVEL IN fc	RANGE OF LIGHTING POWER DENSITY, W/ft ²			
	< 1.0	1.1 - 1.5	1.6 - 2.0	> 2.0
30	3.6	5.1	6.6	8.1
50	3.9	6.0	8.1	10.2
70	4.2	6.9	9.6	12.3

3114.5.3.2 Skylight areas in Tables 3114.5.3.1a and 3114.5.3.1b may be increased by 50 percent if a shading device is used that blocks over 50 percent of the solar gain during the peak cooling design condition.

3114.5.3.3 Areas for vertical glazing in clerestories and roof monitors shall be included in the wall fenestration calculation.

3114.5.4 Floor thermal transmittance criteria: Any building that is heated or mechanically cooled shall have floors that meet the following thermal requirements:

1. Floors of conditioned spaces over unconditioned spaces shall have a thermal transmittance (Uof) less than or equal to that specified in Equation 3114.5.4:

$$U_{of} = 1/(0.840 + 0.00302 \times HDD65) \quad \text{Equation 3114.5.4}$$

2. Slab-on-grade floors shall have insulation around the perimeter of the floor with the thermal resistance (R) of the insulation as specified in Figure 3114.5.4. The insulation specified in Figure 3114.5.4 shall extend either in a vertical plane downward from the top of the slab for the minimum distance shown or downward to the bottom of the slab then in a horizontal plane beneath the slab for the minimum distance shown. The horizontal length, or the vertical depth, of the insulation required varies from 24 inches to 48 inches depending upon the R-value selected. For heated slabs, an R of 2 shall be added to the thermal resistance required in Figure 3114.5.4.

Vertical insulation shall not be required to extend below the foundation footing.

3114.5.5 Thermal transmittance requirements for walls below grade: For walls below grade, the thermal resistance calculated in accordance with Chapter 25 of the ASHRAE Handbook, 1985 Fundamentals Volume shall be greater than or equal to that specified in Equation 3114.5.5:

$$R = 7.5 \times 10^{-4} HDD65 + 4.5 \quad \text{Equation 3114.5.5}$$

3114.5.6 Thermal transmittance requirement for opaque walls enclosing conditioned spaces exposed to interior unconditioned spaces: All opaque portions of walls enclosing conditioned spaces exposed to interior unconditioned spaces shall have an overall thermal transmittance (U_{ow}) not greater than the value specified in Equation 3114.5.6:

$$U_{ow} = 0.0528 + 510.9/HDD65 \quad \text{Equation 3114.5.6}$$

3114.5.7 External wall criteria for heating and cooling: The external wall heating criteria (WCh) and cooling criteria (WCc) shall be determined for a building envelope design per the cited required software program discussed in Section 3114.5.2 (For additional overview, refer to ASHRAE STANDARD 90.1, *ENERGY EFFICIENT DESIGN OF NEW BUILDINGS EXCEPT NEW LOW-RISE RESIDENTIAL BUILDINGS*).

The external wall heating and cooling criteria are determined for each exterior wall orientation of a building using the internal load range as determined in 3114.5.8.4 - 3114.5.8.6.

3114.5.8 Wall heating and cooling compliance values: The wall heating compliance value H_i and the wall cooling compliance value C_i shall be calculated per the cited required software program discussed in Section 3114.5.2 (For additional overview, refer to ASHRAE STANDARD 90.1, *ENERGY EFFICIENT DESIGN OF NEW BUILDINGS EXCEPT NEW LOW-RISE RESIDENTIAL BUILDINGS*).

3114.5.8.1 Applying the criteria: The wall criteria shall be applied as follows:

1. For all buildings that are heated and mechanically cooled, the sum of the calculated wall heating (H_i) and cooling (C_i) compliance values for all orientations of the proposed design as determined in Section 3114.5.7 shall not exceed the sum of the corresponding wall heating (WCh) and wall cooling (WCc) wall criteria for all orientations combined.
2. For buildings that are only heated, the sum of the calculated wall heating compliance values (H_i) for all orientations of the proposed design, as determined in Section 3114.5.7, shall not exceed the sum of the corresponding wall heating criteria, (WCh) criteria for all orientations combined.

3114.5.8.2 Constraints on thermal transmittance values: In applying the wall criteria as described in Section 3114.5.8.1 two constraints are imposed on thermal transmittance values for opaque wall assemblies and fenestration assemblies comprising the U_o term as follows:

1. Opaque wall assemblies: The opaque portion of walls with heat capacity (HC) less than $7 \text{ Btu/ft}^2\text{-}^\circ\text{F}$ shall have an overall thermal transmittance (U_{ow}) not greater than the value specified in equation 3114.5.6.
2. Fenestration Assemblies: The overall thermal transmittance (U_{of}) of fenestration assemblies shall be less than or equal to $0.81 \text{ Btu/ft}^2\text{-h-}^\circ\text{F}$ if the fenestration area exceeds 10% of the total wall. Thermal transmittance for the fenestration shall be determined using the calculation procedures in Section 3114.3.2 and shall include the effects of sash, frames, edge effects and spacers for multiple-glazed units.

3114.5.8.3 Constraint on daylighting credit: For a given orientation, daylight credit may be used in the *ENVSTD* program only for that portion of the fenestration area that is less than or equal to 65 percent of the gross wall area of the orientation.

3114.5.8.4 Lighting power density: The lighting power density used in calculating the compliance value shall be either:

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1. Building average unit Interior Lighting Power Limit in W/ft^2 as specified by the prescriptive criteria in Section 3113.4. (For dwelling units in high rise residential buildings, if Table 3114.4.1 is used, the limit is 0.0 W/ft^2).
2. Designed building average lighting Unit Power Density for those activity areas within 15 feet of each exterior wall based on the procedures set forth by the system performance criteria in Section 3113.5.

3114.5.8.5 Equipment power density: The equipment power density used in determining compliance shall be either:

1. The "Average Receptable Power Densities" from Table 3114.4.1 or
2. The actual average Equipment Unit Power Density, considering diversity in the activity areas within 15 feet of each exterior wall, not to exceed 1 W/ft^2 .

3114.5.8.6 Loads from occupants: Sensible load from occupants is assumed to be 0.6 W/ft^2 . Thus, the sensible load that shall be used is either 0.0 W/ft^2 or the difference between 0.6 W/ft^2 and the actual sensible load.

SECTION 3115.0 BUILDING DESIGN BY SYSTEMS ANALYSIS

3115.1 Scope: This section establishes design criteria in terms of total energy use by a building including all of its systems.

3115.2 Compliance: Compliance with this section is optional and will require an analysis of the annual energy consumption. Sections 3107.0 through 3112.0 establish criteria for different energy consuming and enclosure elements of a low rise residential building. Sections 3107.0, 3108.0 and 3110.0 through 3114.0 establish criteria for different energy consuming and enclosure elements of commercial and high rise residential buildings. These criteria if followed, will eliminate the requirement for an annual energy analysis while meeting the intent of this article.

A low rise residential building designed in accordance with this section will be deemed as complying with this article if the annual energy consumption is not greater than if the building were designed with enclosure elements and energy consuming systems in compliance with Sections 3107.0 through 3112.0.

A commercial or high rise residential designed in accordance with this section will be deemed as complying with this article if the annual energy consumption is not greater than if the building were designed with enclosure elements and energy consuming systems in compliance with Section 3107.0, Section 3108.0 and Sections 3110.0 through 3114.0.

3115.3 Standard design: The standard design, conforming to the criteria of Section 3108.0, and the proposed alternative design, shall be designed on a common basis as specified herein. The comparison shall be expressed as Btu input per square foot of gross floor area per year.

Identical energy sources must serve the same purpose in both the standard and the proposed alternative design. If the proposed alternative design results in an increase in consumption of one (1) energy source and a decrease in another energy source, each energy source shall be converted to equivalent Btu units for purposes of comparing the total energy used.

3115.4 Analysis procedure: The analysis of the annual energy usage of the standard and the proposed alternative building and system design shall meet the following criteria:

1. The building heating/cooling load calculation procedure used for annual energy consumption analysis shall be of sufficient detail to permit the evaluation of the effect of the factors specified in Section 3115.4.1.
2. The calculation procedure used to simulate the operation of the building and its service systems through a full year operating period shall be of sufficient detail to permit the evaluation of the effect of system design, climatic factors, operational characteristics, and mechanical equipment on annual energy usage. Manufacturer's data or comparable field test data shall be used when available in the simulation of all systems and equipment. The calculation procedure shall be based upon eighty-seven hundred and sixty (8760) hours of operation of the building and its service systems and shall utilize techniques recommended in the ASHRAE Handbook, 1985 Fundamentals Volume.

3115.4.1 Calculation procedure: The calculation procedure shall cover the following items:

1. Environmental requirements as indicated in Section 3105.0.
2. Climatic data: coincident hourly data for temperatures, solar radiation, wind and humidity of typical days in the year representing seasonal variation.
3. Building data: orientation, size, shape, transfer characteristics of mass, air, moisture and heat.
4. Operational characteristics: temperature, humidity, ventilation, illumination, control sequence for occupied and unoccupied hours.

5. Mechanical equipment: design capacity, part load profile.
6. Internal heat generation from lighting, equipment, number of people during occupied and unoccupied periods.
7. Electrical equipment: lighting, power consumption.

3115.4.2 Documentation: Proposed alternative designs, submitted as requests for exception to the standard design criteria, shall be accompanied by an energy analysis comparison report prepared by a professional registered engineer or registered architect. The report shall provide sufficient technical detail on the two (2) buildings and systems designs, and on the data used in and resulting from the comparative analysis, to verify that both the analysis and the designs meet the criteria of this article. The documentation shall demonstrate that the analysis used is consistent with ASHRAE calculation procedures and accepted engineering practice.

Exception: Proposed alternative designs for buildings having an area of five thousand (5,000) square feet or less and having the indoor temperature controlled from a single point are exempted from the full year energy analysis as described above. A comparison of energy consumption between the alternative design and the standard design shall be provided in a report prepared by a registered professional engineer or architect. Such analysis shall follow the bin or degree day methods or other simplified analysis procedures consistent with accepted engineering practice.

SECTION 3116.0 BUILDINGS UTILIZING SOLAR, GEOTHERMAL, WIND, OR OTHER NONDEPLETABLE ENERGY SOURCES AS ALTERNATIVE DESIGNS

3116.1 General: When a proposed alternative building, submitted in accordance with Section 3115.0, utilizes solar, geothermal, wind, or other nondepletable energy, that portion supplied to the building shall be excluded from the total energy chargeable to the proposed alternative design.

3116.2 Passive solar energy: The solar energy passing through windows shall be considered if there is a net Btu/year saving over fossil fuel or electric energy systems.

3116.2.1 Nocturnal cooling: This provision shall also apply to nocturnal cooling processes in lieu of energy consuming processes.

3116.2.2 Other criteria: All other criteria covered in Section 3115.0 shall apply to the proposed alternative designs utilizing nondepletable sources of energy.

3116.3 Documentation: Proposed alternative designs, submitted as requests for exception to the standard design criteria shall be accompanied by an energy analysis, as specified in Section 3115.0. The report shall provide sufficient technical detail on the alternative building and system designs and on the data employed in and resulting from the comparative analysis to verify that both the analysis and the designs meet the criteria of this article. The documentation shall demonstrate that the analysis used is consistent with ASHRAE calculation procedures.

Exception: Proposed alternative designs that derive over fifty (50) per cent of their annual thermal requirements (heating, cooling, service water heating) or over thirty (30) per cent of their annual total energy requirements from nondepletable sources shall be exempted from the necessity of comparing the proposed design to a standard design. Documentation, verifying the percentage of annual energy use derived from such nondepletable sources shall be required as provided in Section 3116.3 and shall be prepared by a registered professional engineer or architect.

3116.3.1 Performance data: The energy derived from nondepletable sources and the reduction in conventional energy requirements derived shall be separately identified from the overall building energy use. Supporting documentation, on the basis of the performance estimates for the aforementioned nondepletable energy sources or nocturnal cooling means, must be submitted.

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ARTICLE 32

REPAIR, ALTERATION, ADDITION, AND CHANGE OF USE OF EXISTING BUILDINGS

(This Article is entirely unique to Massachusetts)

SECTION 3200.0 SCOPE

3200.1 General: The provisions of this article are intended to maintain or increase public safety, health, and general welfare in existing buildings by permitting repair, alteration, addition, and/or change of use without requiring full compliance with the code for new construction except where otherwise specified in this article.

3200.2 Compliance: Repairs, alterations, additions, and changes of use shall conform to the requirements of this article. Where compliance with the provisions of this code for new construction, required by this article, is impractical because of structural or construction difficulties or regulatory conflicts, compliance alternatives as described in Section 3206.0 may be accepted by the building official.

Note: Specialized codes, rules, regulations, and laws pertaining to repair, alteration, addition, or change of use of existing buildings promulgated by various authorized agencies may impact upon the provisions of this article. Specialized state codes, rules, regulations, and laws include, but are not limited to those listed in Appendix G.

3200.3 Applicability: The provisions of this article apply to repair, alteration and/or addition to existing buildings which qualify to use this article (see Section 3200.3.1), based on the proposed continuation of or change in use group, as follows:

1. Continuation of the same use group, or a change in use group to a use group of an equal or lesser hazard index number (as listed in Table 3204) shall comply with Section 3203.0.
2. Change in use group to a use group of one (1) or greater hazard index number (as listed in Table 3204) shall comply with Section 3204.0.
3. Change in use group to a use group of two (2) or greater hazard index numbers (as listed in Table 3204) shall comply with the requirements of Section 3205.0 and the code for new construction.

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4. Part change in use: If a portion of the building is changed to a new use group, and that portion is separated from the remainder of the building with vertical and horizontal fire separation assemblies complying with the fire grading required in Table 902, or with approved compliance alternatives, then the portion changed shall be made to conform to the provisions of this article. If a portion of the building is changed to a new use group, and that portion is not separated from the remainder of the building with vertical and horizontal fire separation assemblies complying with the fire grading required in Table 902, or with approved compliance alternatives, then the provisions of this article applying to each use shall apply to the entire building. If there are conflicting provisions, then those requirements which secure the greater public safety shall apply.
5. Additions: Additions to existing buildings shall comply with all code requirements for new construction. The combined height and area of the existing building and new addition shall not exceed that allowed by Table 501 and Sections 501.0 and 506.0. Where a fire wall complying with Section 907.0 is provided, the addition may be considered as a separate building.

No addition shall impose loads which would cause the existing building to be subject to stresses exceeding those permitted by the code for new construction

6. Ordinary repairs: Ordinary repairs conforming to Section 102.0 may be performed without a building permit.
7. Institutional use groups: When there is no change in occupancy within the institutional use group (I), the provisions of Section 3203.0 shall apply. Any change to an institutional use group (I) or any change in occupancy within an institutional use group shall comply with the requirements of the code for new construction.
8. Places of assembly: Nothing contained herein shall prohibit the alteration of a building heretofore occupied as a place of assembly for such continued use, provided that the seats, aisles, passage ways, balconies, stages, appurtenant rooms, and all special permanent equipment shall comply with all applicable provisions for such uses as specified in this code. All buildings changed to an assembly use group (A) or change within the assembly use groups also shall comply with the applicable provisions for such uses as specified in this code and the applicable provisions of this article.

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9. Historic buildings: Buildings which qualify as historic under Section 635.0 need only meet the provisions set forth in that section. The provisions of this article shall apply to historic buildings only when specifically cited in Section 635.0.

3200.3.1 Buildings which qualify: The provisions of this article shall apply to existing buildings which have been legally occupied and/or used for a period of at least five (5) years. No building for which there exists an outstanding notice of violation or other order of the building official shall qualify to use this article unless such proposed work includes correction of all outstanding violations and compliance with all outstanding orders of the building official. Structures which fail to qualify for use of the provisions of this article shall comply fully with the code for new construction.

3200.4 Hazardous exitways: The following exitway conditions shall be deemed to be hazardous when so cited by the building official. The owner of any building where such conditions are cited shall be required to correct such condition immediately:

1. Less than two (2) acceptable exitways serving every story.

Exceptions: One- or two-family dwellings and buildings subject to sections addressing theaters or other places of assembly, or Section 809.3.

2. Any required door, aisle, passageway, stairway, or other required means of egress which is not of sufficient width to comply with Section 808.0 or is not so arranged as to provide safe and adequate means of egress.

SECTION 3201.0 DEFINITIONS

3201.1 General: Definitions shall be construed as being the same as defined in Article 2, except as follows:

Building system: Any mechanical, structural, egress, electrical, plumbing, building enclosure and/or fire protection system, or fire resistive construction system, or portion thereof.

Existing building or structure: Any completed building or structure.

Hazard index: The rating of a use group for relative hazard as listed in Table 3204.

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SECTION 3202.0 IMPLEMENTATION

3202.1 Investigation and evaluation: For any proposed work covered by this article, the building owner shall cause the existing building to be investigated and evaluated in accordance with the provisions of this Article (see Appendix F).

3202.2 Submittal: The results of the investigation and evaluation, along with any proposed compliance alternatives, shall be submitted to the building official.

3202.3 Determination of compliance: The building official shall determine whether the existing building, with the proposed work incorporated, complies with the provisions of this article.

3202.4 Permit application: In addition to the requirements specified in Article 1, the application for a building permit shall include items of non or partial compliance with the requirements of this article, and compliance alternatives, if any are proposed, for approval by the building official. The building official shall respond to the acceptability of any proposed compliance alternatives within thirty (30) days of the filing of the building permit application.

3202.5 Documentation of compliance alternatives: Whenever action is taken on any building permit application to repair, make alterations or additions or change the use or occupancy of an existing building, and when said application proposes the use of compliance alternatives, the building official shall ensure that one (1) copy of the proposed compliance alternatives, including applicable plans, test data, or other data for evaluation, be submitted to the BBRS, along with a copy of the building permit application and the building official's decision regarding the proposed compliance alternatives.

SECTION 3203.0 REQUIREMENTS FOR CONTINUATION OF THE SAME USE GROUP OR CHANGE TO A USE GROUP OF EQUAL OR LESSER HAZARD INDEX

3203.1 General: The requirements of this section shall apply to all repairs and alterations to existing buildings having a continuation of the same use group or to existing buildings changed in use group to an equal or lesser hazard index number (Table 3204).

3203.2 Requirements exceeding those required for new construction: Existing buildings which, in part or as a whole, exceed the requirements of this code may, in the course of compliance with this article, reduce or remove, in part or completely, features not required by this code for new construction.

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3203.3 New systems: Any new building system or portion thereof shall conform to this code for new construction to the fullest extent practical. However, individual components of an existing building system may be repaired or replaced without requiring that system to comply fully with the code for new construction.

3203.4 Alterations and repairs: Alterations or repairs to existing buildings, except for child day care centers as provided for in Section 633.0, which maintain or improve the performance of the building may be made with the same or like materials. Full compliance to the provisions of Section 3203.0 is not required unless there is a change in use.

3203.5 Floor loads: All floors shall be specifically investigated to determine the adequacy of the existing floor system to support the proposed specific floor loads, which shall not be less than those provided in Article 11 for the proposed use group. However, the loads specified in Article 11 may be reduced by a registered professional engineer based on the specific occupancy loads to be encountered, provided such reduction is approved by the building official.

3203.6 Structural loads: Any portion of the existing building which will not safely support the loads of the proposed use group as specified in Article 11 or Section 3203.5 shall be replaced or strengthened to provide such support.

3203.7 Number of exits: Any existing building shall provide at least two (2) means of egress serving every story which are acceptable to the building official.

Exception: One- and two-family dwellings and buildings as modified in sections addressing theaters or other places of assembly, or in Section 809.3 (two-story business buildings).

3203.8 Capacity of exits: All required means of egress shall comply with Section 808.0. Existing means of egress may be used to contribute to the total egress capacity requirement based on the unit egress widths of Section 808.0.

3203.9 Exit signs and lights: Exit signs and lighting shall be provided in accordance with Section 823.0.

3203.10 Means of egress lighting: Means of egress lighting shall be provided in accordance with Section 824.0.

3203.11 Fire alarm systems: Fire alarm systems shall be provided in accordance with Sections 1017.0 and 1018.0.

3203.12 Enclosure of stairways: Open stairways are prohibited except in one- and two-family dwellings or unless otherwise permitted by Article 8. There shall be

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no minimum fireresistance rating required for an existing enclosure of a stairway. Partitions or other new construction which is added in order to fully and solidly enclose a stairway shall provide a minimum fireresistance rating of one (1) hour. All doors in the enclosure shall be self-closing and tight-fitting with approved hardware. All doors in those portions of the stairway which are fireresistance rated shall comply to the applicable portions of Article 9.

3203.13 Places of assembly: Nothing herein contained shall prohibit the alteration of a building heretofore occupied as a place of public assembly for such continued use provided the seats, aisles, passageways, balconies, stages, appurtenant rooms, and all special permanent equipment comply with the requirements of all sections addressing theaters or other places of assembly. All buildings changed to an assembly use group (A) or changed within the assembly use groups shall also comply with all requirements of sections addressing theater or other places of assembly, and the applicable provisions of this article.

3203.14 Fire hazard to adjacent buildings: Any proposed change to the occupancy of an existing building shall not increase the fire hazard to adjacent buildings. If the fire hazard to adjacent buildings is substantially increased, then the requirements of Table 401 for exterior walls shall apply.

3203.15 Increase in the number of dwelling units: In buildings classified in residential use groups (R), the number of dwelling units may be increased up to fifteen (15) per cent without full compliance to the provisions of Section 3203.9 through 3203.11 inclusive. If an increase of greater than fifteen (15) per cent in the number of dwelling units is involved, the building shall comply with the requirements of Section 3203.0. For the purposes of this section only, the base number of dwelling units, which shall be used to calculate percentages of all increases in numbers of dwelling units, shall be that number of dwelling units legally occupied on June 1, 1979.

Exception: Buildings classified in residential use groups (R) containing less than seven (7) dwelling units may be altered to add one (1) dwelling unit without requiring full compliance with the provisions of Section 3203.0.

3203.16 Institutional uses: When there is no change in use or occupancy within the institutional use group (I), the provisions of Section 3203.0 shall apply.

Any change to an institutional use group (I) or any change within an institutional use group shall comply with the requirements of the code for new construction.

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SECTION 3204.0 REQUIREMENTS FOR CHANGE IN USE GROUP TO ONE HAZARD INDEX GREATER

3204.1 General: When the existing use group is changed to a new use group of one (1) hazard index higher (as provided in Table 3204), the existing building shall conform to the requirements of the code for new construction, except as further provided in this section.

3204.2 Mixed use: Compliance is required with Section 313.0 and Table 902 except that floors and walls providing horizontal and vertical separation in buildings of Types 3 and 4 construction shall have a fire-resistance rating of not less than one (1) hour and shall be equipped with a fire suppression system.

3204.3 Restrictions within fire limits: No further compliance is required with Section 906.0. However, if the fire hazard to adjacent buildings is substantially increased due to an increased fire loading, then the requirements of Section 906.0 shall apply.

3204.4 Area and height limitations: No further compliance is required with Sections 501.2 and 501.3 (e.g., a change in use is allowed in an existing building even if it exceeds the area and height limits of Table 501).

3204.5 Accessibility for physically handicapped: No further compliance is required with Section 512.

3204.6 Exitway stairs: Compliance is required with Section 816.0, except that existing exitway stairways may be used as part of the required egress for the new use, provided that the width is of sufficient capacity for the occupancy load, they are structurally sound, and that the enclosures in buildings of Types 3, 4, and 5 construction shall have a fireresistance rating of not less than one (1) hour. Stairway enclosures in buildings of Type 1 and 2 construction shall have a fire resistance rating of not less than two (2) hours. Where stair exitway doors are doors to an apartment or office they need not swing onto the landing. Such doors shall be self-closing and tight-fitting with approved hardware.

3204.7 Earthquake resistance and liquefaction: No further compliance to Sections 1113.0 and 1201.0 is required. Structural alterations may be made to existing buildings, but the resistance to lateral forces shall not be less than before such alterations were made, unless the building as altered meets the requirements of this code for earthquake loads.

3204.8 Mortar: No further compliance is required with Section 815.0.

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3204.9 Fire and party walls: No further compliance is required with Section 907.0. The height above the roof of existing fire, party and exterior walls need not comply with this section.

Table 3204
HAZARD INDEX

Scale: 1-8 (1 is lowest, 8 is highest hazard)

USE GROUP	DESCRIPTION	INDEX NO.**
A-1	Theater with stage	6
A-1	Theater without stage	5
A-2	Night Club	7
A-3	Restaurant Lecture halls, recreations centers, museums, libraries. similar assembly buildings	5 <u>4</u>
A-4	Churches	4
<u>A-5</u>	<u>Outdoor Assembly</u>	<u>4</u>
B	Business	2
<u>E</u>	<u>Educational</u>	<u>4</u>
<u>F-1 & F-2</u>	Factory and industrial	3
H	High hazard	8
<u>I-3</u>	Institutional restrained	5
I-2	Institutional incapacitated	4
M	Mercantile	3
R-1	Hotels, motels	2
R-2	Multi-family	2
R-3	One and two family	2
S-1	Storage, moderate hazard	3
S-2	Storage, low hazard	1

Notes to Table 3204:

* See Section 203.0 through 212.0 and Appendix F.

** Hazard Index Modifier for selected construction types.

When a building is classified in Construction Type 1A, 1B, 2A, or 2B, subtract one (1) from the Hazard Index number shown in Table 3204 for the applicable proposed new use group only.

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SECTION 3205.0 REQUIREMENT FOR CHANGE IN USE GROUP TO TWO OR MORE HAZARD INDICES GREATER

3205.1 General: When the existing use group is changed to a new use group of two (2) or more hazard indices higher (as provided in Table 3204), the existing building shall conform to the requirements of the code for new construction.

SECTION 3206.0 COMPLIANCE ALTERNATIVES

3206.1 General: Where compliance with the provisions of the code for new construction, required by this article, is impractical because of structural or construction difficulties or regulatory conflicts, compliance alternatives may be accepted by the building official.

Some compliance alternatives which have been used are provided in Appendix F. The building official may accept these compliance alternatives or others proposed.

3206.2 Documentation: In accordance with Section 3202.5, the building official shall ensure that the Commission is provided with information regarding compliance alternatives accepted or rejected by him.

SECTION 3207.0 ENERGY PROVISIONS FOR EXISTING BUILDINGS

3207.1 General: This section establishes the energy provisions for existing buildings governed by Section 3203.0. Existing buildings governed by Sections 3204.0, 3205.0, or by the code for new construction shall comply with the requirements of Article 31 for new construction.

3207.2 Compliance alternatives: Alterations to any of the building elements of an existing building must comply with Table 3207 on either a component basis; or an equivalent energy usage analysis basis; or a system analysis basis.

3207.2.1 Component basis: Alterations to any of the building elements (walls, windows, doors, roofs or mechanical systems) shall comply with Table 3207 and the applicable subsections of Article 31 for the altered elements only.

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3207.2.2 Equivalent energy usage analysis: Alterations to any of the building envelope elements (walls, windows, doors, or roof) may be adjusted so that the energy losses of any element may be increased or decreased as long as the total does not exceed that which would have been calculated for the individual components.

3207.2.3 Systems analysis: Refer to Section 3113.0 of this code for design criteria for systems analysis.

3207.3 Exempt buildings: Refer to Section 3101.4 for thermally exempt buildings and Section 3115.0 for lighting exemptions.

3207.4 Compliance exceptions

3207.4.1 Fenestration: When alterations to a wall assembly include only altering the fenestration component, the areas of fenestration may be decreased or replaced with an opaque wall element made to comply with the thermal transmittance value of the existing wall.

3207.4.2 Ordinary repairs: Ordinary repairs need not comply with the energy provisions.

3207.4.3 Roofs: Compliance of the roof/ceiling assembly is not required unless the existing roofing material is stripped off the roof deck. However, if a structural analysis by a registered professional engineer shows that the roof will not support the additional live loads imposed by compliance of the roof/ceiling assembly, or, if such analysis shows that addition of the required amount of insulation will cause ponding of water, then compliance of the roof/ceiling assembly is not required.

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**TABLE 3207
COMPONENT VALUES FOR ALTERED ELEMENTS**

WALLS	All wall construction containing heated or mechanically cooled space	0.08	6,8
Foundation Walls Including Band	Containing heated or mechanically cooled space	0.08	4
	Containing unheated space	0.17	
Roof/Ceiling Assy	Wood plank and beam construction containing heated or mechanically cooled space	0.08	1
Roof/Ceiling Assy	Construction other than wood plank and beam containing heated or mechanically cooled space	0.05	
Doors, Skylights and Windows	All construction enclosing heated or mechanically cooled space	0.65 0.65	2, 7 5 6
Floors	Floor sections over area exposed to outside air or unheated areas	0.08	3
	Unheated slab on grade	5.50 (R)	
	Heated slab on grade	7.75 (R)	
Mechanical Equipment	Heating, cooling, sizing and efficiency	Sect. <u>3110.0</u> , <u>3111.0</u>	9
Equipment Controls	Humidistats, thermostats & zoning	Sect. <u>3110.0</u>	9
Duct and Pipe Insulation and Construction	Located in or on buildings	Sect. <u>3110.9</u> <u>3110.12</u>	
Electrical Equip. & Power Dist.		Sect. <u>3110.0</u> <u>3111.0</u> , <u>3112.0</u>	
Lighting	Lighting	Sect. <u>3113.0</u>	

Notes to Table 3207:

- Note 1.** Wood plank and beam assemblies are constructions in which the finished interior surface is the underside of the roof deck.
- Note 2.** Double glazing or storm windows will satisfy the required U Value of 0.65.

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- Note 3.** Insulation may be omitted from floors over unheated areas when foundation walls are provided with a U value of 0.17.
- Note 4.** The U value requirement of 0.17 for foundation walls may be omitted when floors over unheated spaces are provided with a U value of 0.08.
- Note 5.** Allowable air infiltration values for windows - .50 cfm/lin. ft. of operable sash crack; residential doors - (sliding) .50 cfm/sf., (entrance) 1.25 cfm/sf.; commercial doors 11 cfm/lin.ft.
- Note 6.** The first floor exterior envelope of business and mercantile use groups shall have an overall thermal transmittance value not greater than .65 in lieu of individual component values for walls and fenestration.
- Note 7.** When the glass area is increased, the glass and wall components which are altered shall comply with the component values in Table 3207. The extent of wall made to comply shall be equivalent to the decreased opaque wall area.
- Note 8.** When any alterations to the exterior wall component exposes the wall cavity or, when a finished system is added to a wall having no cavity, the wall must comply with the values in Table 3207.
- Note 9.** When mechanical system compliance is required on an existing system, only the portions of the system altered and any other portions which can reasonably be incorporated need comply.

SECTION 3208.0 OTHER CODE SECTIONS PERTAINING TO REPAIR, ALTERATION, OR CHANGE OF USE OF EXISTING BUILDINGS

3208.1 General: The following is a list of some additional code sections which may pertain to repair, alteration, or change of use of existing buildings:

- 101.0 Applicability
- 102.0 Ordinary Repairs
- 103.0 Installation of Service Equipment
- 104.0 Maintenance
- 105.0 Change in Existing Use
- 106.0 Alterations and Repairs
- 108.5.1 Duties and Powers of the Building Official and State Inspector
 - Inspection and Certification - Specified Use Groups
- 111.1 Preliminary Inspection
- 116.0 Demolition of Structures
- 117.0 Moved Structures
- 119.2 Certificate of Use and Occupancy - Buildings or Structures
 - Hereafter Altered
- 120.0 Posting Structures
- 121.0 Violations
- 123.0 Unsafe Structures
- 124.0 Emergency Measures
- 506.0 Street Encroachments
- 627.0 Fire Prevention Code

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- 629.0 Existing Buildings
- 609.0 Public Garages
- 617.0 Places of Public Assembly other than Theaters
- 624.0 Group Residence
- 607.0 Open Parking Structures
- 637.0 Day Care Centers
- 638.0 Summer Camps for Children - New and Existing Occupancies
- 639.0 Historic Buildings
- 637.0 Detoxification Facilities
- 702.0 Existing Buildings (Light, Ventilation and Sound Transmission Control)
- 800.1 Means of Egress - Scope
- 800.2 Modification of Exitway Requirements
- 805.0 Maintenance of Exitways
- 821.0 Fire Escapes
- 1105.0 Structural and Foundation Loads and Stresses - Existing Buildings
- 1113.0 Earthquake Loads - Minor Alterations
- 2102.0 Flood Resistant Construction
- 1306.0 Heretofore Approved Materials
- 926.0 Exterior Trim Restrictions - Existing Combustible Construction
- 2301.0 Roof Covering - Existing Roof
- 1000.3 Fire Protection Systems - Maintenance
- 1000.8 Fire Protection Systems - Periodic Inspections and Tests
- 1001.1 Fire Protection Systems - Plans and Specifications - Required
- 1001.2 Fire Protection Systems - Plans and Specifications - Approved by other Agencies
- 1012.7 Standpipes for Buildings Under Demolition
- Article 13 Precautions During Building Operations
- 2903.0 Unsafe and Unlawful Signs - Notices
- 2904.0 Existing Signs
- 2905.0 Signs - Maintenance and Inspection
- 3101.3 Energy Conservation - Existing Buildings
- 3101.4 Energy Conservation - Exempt Buildings
- 3100.2.4 Building Code Provisions for One- and Two-Family Dwellings - Alterations to Existing Buildings

Mechanical Code:

- Chimneys, Flues, and Vent Pipes - Existing Buildings
- Mechanical Equipment and Systems - Existing Buildings

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ARTICLE 33

MANUFACTURED BUILDINGS, BUILDING COMPONENTS AND MOBILE HOMES

(This Article is entirely unique to Massachusetts)

SECTION 3300.0 GENERAL

3300.1 Installation in the State: The provisions of this article shall govern the materials, design, manufacture, handling, storage, transportation, assembly, construction and/or installation of manufactured buildings and building components intended for installation in the Commonwealth of Massachusetts. Manufactured buildings or building components shall not be installed in any jurisdiction of this State unless such manufactured buildings or building components have been approved and certified, in accordance with the applicable codes as provided in this article, applicable provisions of the code, and the Rules and Regulations for Manufactured Buildings, Building Components and Mobile Homes of the Board of Building Regulations and Standards(BBRS) and hereinafter referred to in this article as the "rules and regulations."

Exception: All manufactured buildings and building components manufactured prior to January 1, 1975, with the approval of the building official and which met all the requirements of state laws , rules and regulations, or local by-laws or ordinances in force at that time shall be deemed approved in accordance with the provisions of Section 114.4 of this code; provided that such manufactured buildings or building components are used for the purpose and within the limitations for which they were approved and provided such uses are not detrimental to the health and safety of the occupants and the public.

3300.2 Manufactured in the State: The provisions of this article shall also govern manufactured buildings and building components manufactured in the State for shipment to any other State or government jurisdiction where such manufactured buildings and building components and the label thereon are accepted.

3300.3 Mobile homes: The article shall also govern the installation within the State of all mobile homes. The evaluation and approval of all mobile homes for installation

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in the State shall be in accordance with the Mobile Home Construction and Safety Standards of the U. S. Department of Housing and Urban Development (hereinafter referred to as "HUD") as listed in Appendix A.

Exception: All mobile homes manufactured between January 1, 1975 and July 17, 1976 and sold, delivered to or installed on building sites in any jurisdiction of this State shall comply with the provisions of ANSI A119.1 (1974 edition) as amended by the Board of Building Regulations and Standards with this article and the rules and regulations pursuant thereto.

SECTION 3301.0 APPROVAL

3301.1 General: The Commonwealth of Massachusetts, Department of Public Safety, Division of Inspection (hereinafter referred to as the "Division of Inspection" in this article) shall evaluate manufactured buildings and building components and recommend approval to the BBRS of those which it determines to be in compliance with applicable sections of this article, other applicable sections of this code, and the rules and regulations.

However, all approvals of plumbing, electrical or gas systems shall be made by the appropriate state agencies having jurisdiction, as specified in the rules and regulations.

3301.2 Approved tests: The Division of Inspection may utilize the results of approved tests to determine whether a manufactured building or building component meets the requirements of this article and the rules and regulations, if that determination cannot be made from evaluation of plans, specifications and documentation alone.

3301.3 Approval of compliance assurance programs: The Division of Inspection shall evaluate manufacturers' compliance assurance programs and make recommendations for approval to the BBRS of those which it determines to be in compliance with this article and the rules and regulations.

3301.4 Authorization to vary: A manufactured building, building component or a compliance assurance program which has approval shall not be varied in any way without prior authorization by the Division of Inspection in accordance with the rules and regulations.

SECTION 3302.0 CERTIFICATION

3302.1 Labeling: Any manufactured building or building component which has approval, in accordance with section 3301.0, shall have an approved device or seal affixed as certification of such approval.

SECTION 3303.0 RECIPROCITY

3303.1 General: If the BBRS finds that the standards for manufacture and inspection of manufactured buildings or building components prescribed by the statutes or rules and regulations of another state or other governmental agency meet the objectives of this article and the rules and regulations, and such standards are enforced satisfactorily by such other state or governmental agency or by its agents, the BBRS shall grant approval and the Division of Inspection shall accept all manufactured buildings or building components which have been approved by such other state or governmental agency and shall insure that the product is properly labeled.

3303.1.1 Condition of reciprocity: The standards of another state shall not be deemed to be satisfactorily enforced unless such other state provides for notification to the Division of Inspection of suspensions or revocations of approvals issued by that other state, in a manner satisfactory to the BBRS.

3303.2 Suspension of reciprocal approval: The Division of Inspection shall suspend or cause to be suspended reciprocal approval for the following reasons:

1. if it determines that the standards for the manufacture and inspection of such manufactured buildings or building components of another state or other governmental agency do not meet the objectives of this article and the rules and regulations or that the standards are not being enforced to the satisfaction of the Division of Inspection; and
2. if another state or governmental agency, or its agent, suspends or revokes its approval, the approval granted under this section shall be suspended or revoked accordingly.

SECTION 3304.0 ASSURANCE INSPECTION

3304.1 General: Any person or firm manufacturing buildings or building components desiring certification shall agree in writing that the Division of Inspection has the right to conduct unannounced inspections at any reasonable time.

3304.2 Responsibilities of Division of Inspection: The Division of Inspection shall carry out the following responsibilities:

1. Periodically make, or cause to be made, inspections of the entire process of manufacture of buildings or building components in order to verify the reliability of the compliance assurance program and of the approved inspection agency.
2. In addition to other on-site inspection provided for in this section, the Division of Inspection shall inspect, or cause to be inspected, certified

manufactured buildings or building components which it determines to have been sufficiently damaged after certification to warrant such action with regard to such buildings or building components as is authorized hereof, or as is otherwise necessary to eliminate dangerous conditions.

Note: An inspection entailing disassembly, damage to or destruction of certified manufactured buildings or building components shall not be conducted except to implement the provisions of this article.

SECTION 3305.0 RESPONSIBILITY OF THE LOCAL ENFORCEMENT AGENCIES

3305.1 Issuance of building permits: Upon application and in conformity with the provisions of this code, the building official shall issue building permits for installation of certified manufactured buildings or building components or mobile homes.

3305.2 Inspection: The local enforcement agency shall make the following inspections

1. The site preparation work, including foundations, installation of any certified manufactured buildings or building components or approved homes; and for all utility service connections, including plumbing, electrical, gas, water and sewer; for compliance with the applicable codes.
2. Inspect all certified manufactured buildings or building components or approved mobile homes upon, or promptly after, installation at the building sites to determine whether all applicable instructions or conditions have been followed. This may include tests for tightness of plumbing and mechanical systems, for malfunctions in the electrical system, and a visual inspection for obvious violations of the rules and regulations. Destructive disassembly of certified buildings or building components or approved mobile homes shall not be performed in order to conduct such inspections. Nondestructive disassembly may be performed only in accordance with the rules and regulations.

3305.3 Issuance of certificates of occupancy: The building official shall issue a certificate of occupancy for all certified manufactured buildings or approved mobile homes that have been installed and inspected and that meet the requirements of this code.

SECTION 3306.0 SUSPENSION OR REVOCATION OF CERTIFICATION

3306.1 General: The Board shall suspend or revoke the approval of any manufactured building or building component which does not comply with the provisions of this code or with the rules and regulations.

3306.2 Labels of certification: The Division of Inspection shall remove or cause to be removed the label of certification from any such manufactured building or building component not in compliance until such time as it is brought into compliance with this article and the rules and regulations.

3306.3 Notice of suspension or revocation: Notice shall be submitted in writing to the affected parties stating the reason for the suspension or revocation.

3306.4 Appeals Procedure: All appeals from suspension or revocation shall be heard by the State Building Code Appeals BBRS as specified in the pertinent provisions of Section 126.0 of this code.

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ARTICLE 34

BUILDING CODE PROVISIONS FOR ONE AND TWO-FAMILY DWELLINGS

(This Article is entirely unique to Massachusetts - Except for reformatting and minor typographical changes, it is the same as Article 21 of the Fourth Edition of the Massachusetts State Building Code.)

SECTION 3400.0 GENERAL

3400.1 Scope: Contained within Article 34 of the State Building Code are provisions which shall regulate one- and two-family dwellings. These provisions are supplied to provide a single comprehensive reference for one and two-family dwellings. These provisions shall be considered as being applicable as stated.

3400.1.1 Basic code provisions: The requirements for one and two-family dwellings are stated in other articles of the basic code on a performance-oriented basis and may be used at the option of the designer. In addition, any requirements for which provisions are not made within this article shall be subject to the provisions of the other articles of the basic code.

3400.1.2 Reference standards: * Standards referenced in the text of Article 34 represent recognized practices and specifications to be applied specifically using Article 34. These reference standards are located immediately after the text of Article 34. Other reference standards contained in the Basic Code may be used at the option of the designer, in accordance with the provisions of Section 3400.1.1.

*Editorial addition

3400.2 Energy conservation

3400.2.1 Building design: Building design shall be based on compliance with the energy conservation performance standards of the basic code. If systems analysis or non-depletable energy sources are used, refer to Article 31.

3400.2.2 Exempt buildings: The following buildings are exempt from the energy conservation provisions of this article:

1. Buildings and structures or portions thereof whose peak design rate of energy usage is less than one (1) watt per square foot or three and four tenths (3.4) Btu/h per square foot of floor area for all purposes.

2. Buildings which are neither heated nor cooled.

3400.2.3 Additions to existing buildings: Additions to existing buildings or structures may be made without making the entire building or structure comply with the requirements of this code. The new construction shall conform to the requirements of this article as they relate to the addition only.

3400.2.4 Alterations to existing buildings: Alterations to existing buildings shall comply with this article on a component basis. When there are alterations to or replacement of the building enclosure elements (walls, roof or floors) or mechanical systems, those components only shall comply.

3400.3 Definitions

3400.3.1 Meaning: Unless otherwise expressly stated, the following terms shall, for the purpose of this code, have the meaning indicated in this section.

3400.3.2 Tense, gender and number: Words used in the present tense include the future; words used in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural the singular.

3400.3.3 Terms not defined: Where terms are not defined, they shall have their ordinarily accepted meanings or such as the context may imply. Any terms relating to plumbing and electrical wiring shall have their terms as defined by the Regulations of the Commonwealth of Massachusetts pertaining to plumbing and electrical wiring.

Accepted engineering practice: That which conforms to accepted principles, tests or standards of nationally recognized technical or scientific authorities.

Accessory structure: A building or structure, the use of which is incidental to that of the main building or structure and which is located on the same lot.

Accessory use: A use incidental to the principal use of a building as defined or limited by the provisions of the local zoning laws.

Addition: An extension or increase in floor area or height of a building or structure.

Air-conditioning: The treatment of air so as to control simultaneously its temperature, humidity, cleanness and distribution to meet the requirements of a conditioned space.

Air duct: A tube or conduit used for conveying air.

Alteration: A change or modification of a building or structure, or the service equipment thereof, that affects safety or health and that is not classified as ordinary repairs.

Alternate inspector: A person appointed to act in the absence of the inspector of buildings in case of illness, disability, or conflict of interest.

Approved: Approved by the commission, the building official or accepted engineering practice. (See Section 110.0.)

Approved material, equipment and methods: Approved by the Commission or by an agency approved by the Commission.

Approved rules: Those rules approved by the State Building Code Commission unless otherwise specified.

Area (building): The area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if included within the horizontal projection of the roof or floor above.

Areaway (form of construction): An uncovered subsurface space adjacent to a building.

Attic: The space between the ceiling beams of the top habitable story and the roof rafters.

Attic (habitable): A habitable attic is an attic which has a stairway as a means of access and egress and in which the ceiling area at a height of seven and one-third (7-1/3) feet above the attic floor is not less than one-third (1/3) the area of the floor next below.

Automatic detecting device: A device which automatically detects heat, smoke or other products of combustion.

Automatic fire alarm system: A system which automatically detects a fire condition and actuates a fire alarm signal device.

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Basement: That portion of a building which is partly below and partly above grade, and having at least one-half ($1/2$) its height above grade (see "Grade", "Story" and "Cellar").

Basic code: The State Building Code of the Commonwealth of Massachusetts, also referred to as "this Code".

Bay (part of a structure): The space between two (2) adjacent piers or mullions or between two (2) adjacent lines of columns.

Bay window: A window projecting beyond the wall line of a building.

Board of Building Regulations and Standards (BBRS): The Massachusetts Board responsible for the development, promulgation, and enforcement of the Massachusetts State Building Code. Replaces the former State Building Code Commission.

Boiler: A closed heating appliance intended to supply hot water or steam for space heating, processing or power purposes.

Boiler capacity: The amount of heat output in Btu/h at the design temperature rise and rated input.

Brick (clay or shale): A solid masonry unit of clay or shale, usually formed into a rectangular prism while plastic and burned or fired in a kiln.

Calcium-silicate brick (sand lime brick): A building unit made of sand and lime.

Concrete brick: A solid masonry unit having a shape approximately a rectangular prism and composed of inert aggregate particles embedded in a hardened cementitious matrix.

Hollow brick: A masonry unit of clay or shale whose net crosssectional area in any plane parallel to the bearing surface is not less than sixty (60) per cent or more than seventy-five (75) per cent of its gross cross-sectional area measured in the same plane.

Building: Any structure used or intended for supporting or sheltering any use or occupancy.

Building commissioner: The administrative chief of the building department in a municipality who is charged with the administration and enforcement of this code. See also Inspector of Buildings and Section 107.1.

Building component: Any subsystem, subassembly or other system designed for use in or as part of a structure.

Building department: The person, body, agency, department or office of any municipality charged with the administration and enforcement of this code.

Building envelope: The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior.

Building, existing: Any structure erected or one for which a legal building permit has been issued prior to the adoption of this code (and its amendments).

Building line: The line established by law, beyond which a building shall not extend, except as specifically provided by law.

Building official: The officer or other designated authority charged with the administration and enforcement of this code. Building official as used herein includes the building commissioner or the inspector of buildings and the local inspector.

Building service equipment: The mechanical, electrical and elevator equipment, including piping, wiring, fixtures and other accessories, which provide sanitation, lighting, heating, ventilation, fire-fighting and transportation facilities essential for the habitable occupancy of the building or structure for its designated use and occupancy.

Building site: The area occupied by a building or structure, including the yards and courts required for light and ventilation, and such areas that are prescribed for access to the street.

Buttress: A projecting part of a masonry wall built integrally therewith to furnish lateral stability which is supported on proper foundations.

Cellar: That portion of a building which is partly or completely below grade and having at least one-half (1/2) its height below grade (see "Grade", "Story" and "Basement").

Certificate of use and occupancy: The certificate issued by the building official which permits the use of a building in accordance with the approved plans and specifications and which certifies compliance with the provisions of law for the use and occupancy of the building in its several parts together with any special stipulations or conditions of the building permit.

Change of use: An alteration by change of use in a building heretofore existing to a new use group or sub-use group which imposes other special provisions of law governing building construction, equipment or means of egress.

Chimney: A primarily vertical enclosure containing one (1) or more passageways.

Factory-built chimney: A chimney that is factory-made, listed by a nationally recognized testing or inspection agency, for venting gas appliances, gas incinerators and solid or liquid fuel burning appliances.

Masonry chimney: A field constructed chimney of solid masonry units, bricks, stones, listed hollow masonry units or reinforced concrete built in accordance with nationally recognized standards.

Metal chimney (smokestack): A field constructed chimney made of metal and built in accordance with nationally recognized standards.

Chimney connector: A pipe which connects a fuel burning appliance to a chimney.

Clay masonry unit: A building unit larger in size than a brick, composed of burned clay, shale, fireclay or mixtures thereof.

Combination of municipalities: Any two or more cities and/or towns who have agreed to combine in order to share costs necessary for the administration and enforcement of this code in the said cities and/or towns.

Combustible (material): A combustible (material) is a material which cannot be classified as noncombustible in accordance with that definition.

Commenced: Any physical action begun on the job site for the purposes of construction for which a building permit is required.

Commission: See State Building Code Commission. Replaced by the BBRS.

Component: An integral part of a building or its mechanical systems; an element of a building envelope.

Concrete: A mixture of cement, aggregates and water, of such proportions and manipulation as to meet specific requirements.

Concrete masonry unit: A building unit or block larger in size than twelve (12) by four (4) by four (4) inches made of cement and suitable aggregates.

Conditioned floor area: All portions of interior gross floor area which are contained within exterior walls and which are conditioned directly or indirectly by an energy-using system. (See gross floor area).

Conflagration hazard: The fire risk involved in the spread of fire by exterior exposure to and from adjoining buildings and structures.

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Construction operation: The erection, alteration, repair, renovation, demolition or removal of any building or structure; and the excavation, filling, grading and regulation of lots in connection therewith.

Construction supervisor: Any individual directly supervising persons engaged in construction, reconstruction, alterations or repairs involving the structural elements of buildings and structures.

Controlled construction: The construction of a building or structure or a specific part thereof which has been designated and erected under the supervision of a licensed professional engineer or architect using controlled materials as herein defined in compliance with accepted engineering practice under the procedure of Section 127.0.

Corridor: A hallway, passageway or other compartmented space providing the occupants with access to the required exitways of the building or floor area.

Court: An open, uncovered, and unoccupied space on the same lot with a building.

Inner court: Any court other than an outer court.

Outer court: A court extending to and opening upon a street, public alley, or other approved open space, not less than fifteen (15) feet wide, or upon a required yard.

Degree day, heating: A unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65 F there exist as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65 F.

Department/DPS: The Department of Public Safety, Division of Inspections.

Draft: The pressure difference existing between the equipment or any component part of the atmosphere which causes a continuous flow of air and products of combustion through the gas passages of the appliance to the atmosphere.

Forced draft: The pressure difference created by the action of a fan, blower or ejector which supplies the primary combustion air above atmospheric pressure.

Induced draft: The pressure difference created by the action of a fan, blower or ejector which is located between the appliance and the chimney or vent termination.

Natural draft: The pressure difference created by a vent or chimney due to its height and the temperature difference between the flue gases and the atmosphere.

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Draft regulator: A device which functions to maintain a desired draft in the appliance by automatically reducing the draft to the desired value.

Duct: A tube or conduit used for conveying or encasing purposes as specifically defined below:

Air duct: A tube or conduit used for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

Pipe duct: A tube or conduit used for encasing pipe.

Wire duct: A tube or conduit used for encasing either moving or stationary wire, pipe, etc.

Dwellings:

One-family dwelling: A building containing one (1) dwelling unit with not more than three (3) lodgers or boarders.

Two-family dwelling: A building containing two (2) dwelling units with not more than three (3) lodgers or boarders per family but not more than twenty (20) individuals.

Dwelling unit: A single unit providing complete, independent living facilities for one (1) or more persons including permanent provisions for living, sleeping, eating, cooking, and sanitation.

Energy: The capacity for doing work. Energy takes a number of forms which may be transformed from one into another, such as thermal (heat), mechanical (motion), electrical, and chemical. In customary units, energy is measured in kilowatt-hours (kwh) or British thermal units (Btu).

Energy efficiency ratio (EER): The ratio of net cooling capacity in Btu/h to total rate of electric input in watts under designated operating conditions.

Existing building: See "Building, existing".

Existing equipment: Any equipment covered by this article which was installed prior to the effective date of this code or for which an application for permit to install was filed with the building official prior thereto.

Exitway: That portion of a means of egress which is separated from all other spaces of a building or structure by construction or equipment as required in this code to provide a protected way of travel to the exitway discharge.

Exterior envelope: The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior.

Fenestration: Any light-transmitting device in the building envelope admitting natural light.

Fire door: A door and its assembly, so constructed and assembled in place as to give protection against the passage of fire.

Fire door assembly: The assembly of a fire door and its accessories, including all hardware and closing devices and their anchors; and the door frame, when required, and its anchors.

Fireresistance: That property of materials or their assemblies which prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

Fireresistance rating: The time in hours or fractions thereof that materials or their assemblies will resist fire exposure as determined by fire tests conducted in compliance with recognized standards.

Fire separation wall: A fireresistance rated assembly of materials not having unprotected openings, designed to restrict the spread of fire.

Fire wall: A fireresistance rated wall, having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof.

Fire window: A window constructed and glazed to give protection against the passage of fire.

Flameresistance: The property of materials or combinations of component materials which restricts the spread of flame as determined by the flameresistance tests specified in this code.

Flame spread: The propagation of flame over a surface.

Flame spread rating: The measurement of flame spread on the surface of materials or their assemblies and determined by tests conducted in compliance with recognized standards.

Flammable: Subject to easy ignition and rapid flaming combustion.

Floor area, gross: Gross floor area shall be the floor area within the perimeter of the outside walls of the building under consideration, without deduction for hallways, stairs, closets, thickness of walls, columns, or other features.

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Floor area, net: For the purpose of determining the number of persons for whom exitways are to be provided, net floor area shall be the actual occupied area, not including accessory unoccupied areas or thickness of walls.

Foundation: A base constructed to support any building or structure including but not limited to footings, floating foundation, piles, caissons.

Foundation wall: A wall below the floor nearest grade serving as a support for a wall, pier, column or other structural part of a building.

Fuel: A solid, liquid, or gaseous substance with a high energy content that can be burned to release the energy.

Fuel oil: A liquid mixture or compound derived from petroleum which does not emit flammable vapor below a temperature of one hundred and twenty-five (125) degrees F. in a Tag closed-cup tester (ASTM D56).

Furnace

Floor furnace: A self-contained, connected or vented furnace designed to be suspended from the floor of the space being heated taking air for combustion outside this heated space and with means for observing the flame and lighting the appliance from the space being heated.

Forced warm air furnace: A furnace equipped with a blower to provide the primary means for circulating air.

Warm air furnace: A solid, liquid or gas-fired appliance for heating air to be distributed with or without duct systems to the space to be heated.

Garage, private: A garage for four (4) or less passenger motor vehicles without provision for repairing or servicing such vehicles for profit.

Grade: A reference plane representing the average of finished ground level adjoining the building at all exterior walls.

Grade hallway, grade lobby, grade passageway: An enclosed hallway or corridor that is an element of an exitway, terminating at a street or an open space or court communicating with a street.

Heat: The form of energy that is transferred by virtue of a temperature difference.

Habitable space: Space in a structure for living, sleeping, eating, or cooking. Bathrooms, toilet compartments, closets, halls, storage or utility space, and similar areas are not considered habitable space.

Heated slab: Containing heating pipes or ducts that constitute a radiant slab or portion thereof for complete or partial heating of the house.

Heating appliance: Any device designed or constructed for the generation of heat from solid, liquid or gaseous fuel or electricity.

Recessed heater: A completely self-contained heating unit usually recessed in a wall and located entirely above the floor of the space it is intended to heat.

Unit heater: A factory-assembled device designed to heat and circulate air. Essential components are a heat transfer element, housing and fan with driving motor. Normally designed for free delivery of recirculated air.

Heated space: A space within a building which is provided with a positive heat supply to maintain air temperature of fifty (50) degrees F. or higher.

Height, building: The vertical distance from the grade to the top of the highest roof beams of a flat roof, or to the mean level of the highest gable or slope of a hip roof. When a building faces on more than one (1) street, the height shall be measured from the average of the grades at the center of each street front.

Height, court: The vertical distance from the lowest level of the court to the mean height of the top of the enclosing walls.

Height, story: The vertical distance from top to top of two (2) successive tiers of beams or finished floor surfaces; and, for the topmost story, from the top of the floor finish to the top of the ceiling joists, or, where there is not a ceiling, to the top of the roof rafters.

Height, wall: The vertical distance from the foundation wall or other immediate support of such wall to the top of the wall.

Hereafter: After the time that this code becomes effective.

Heretofore: Before the time that this code becomes effective.

Hollow masonry unit: A masonry unit whose net cross-sectional area in any plane parallel to the bearing surface is less than seventy-five (75) per cent of its gross cross-sectional area measured in the same plane.

Humidistat: An instrument which measures changes in humidity and controls a device(s) for maintaining a desired humidity.

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HVAC: Heating, ventilating, and air conditioning.

HVAC system: A system that provides either collectively or individually the processes of comfort heating, ventilating, and/or air-conditioning within or associated with a building.

Infiltration: The uncontrolled inward air leakage through cracks and interstices in any building element and around windows and doors of a building, caused by the pressure effects of wind and/or the effect of differences in the indoor and the outdoor air density.

Inspector of buildings: The administrative chief of the building department in a municipality who is charged with the administration and enforcement of this code. See also building commissioner. (See Section 107.1).

Interior lot line: Any lot line other than one adjoining a street or public space.

Lintel: A beam placed over an opening or recess in a wall which supports the wall construction above.

Local enforcement agency: A department or agency in a municipality charged with the enforcement of this code and appropriate specialized codes which include, but are not limited to, the Massachusetts Plumbing Code, Massachusetts Fuel Gas Code, and the Massachusetts Electrical Code.

Local inspector: A person in a municipality who assists the building commissioner or inspector of buildings in the performance of his duties and is charged with the enforcement of this code. (See Section 107.11).

Lot: A portion or parcel of land considered as a unit.

Corner lot: A lot with two (2) adjacent sides abutting upon streets or other public spaces.

Interior lot: A lot which faces on one (1) street or with opposite sides on two (2) streets.

Lot line: A line dividing one lot from another, or from a street or any public place.

Maintenance: Restoring or replacing deteriorated elements.

Manual: Capable of being operated by personal intervention. (See automatic).

Masonry: A built-up construction or combination of building units or materials of clay, shale, concrete, glass, gypsum, stone or other approved units bonded together with mortar or monolithic concrete. Reinforced concrete is not classed as masonry.

Means of egress: A continuous and unobstructed path of travel from any point in a building or structure to a public way.

Mechanical ventilation: The mechanical process of supplying air to, or removing air from, any space.

Mortar: A plastic mixture of approved cementitious materials, fine aggregates and water used to bond masonry or other structural units.

Municipality: Any city or town in the Commonwealth of Massachusetts. The word "municipality" shall be construed, where the context requires, as though followed by the words "or combination of municipalities".

Native lumber: Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with the regulations of the Board of Building Regulations and Standards. Such wood is ungraded but is stamped or certified in accordance with the requirements of Section 1701.1.2 of the code. For the purpose of this definition, native lumber shall be restricted to use in one and two-story dwellings, barns, sheds, agricultural and accessory buildings and structures, and other uses when permitted by section 1701.1.2.

Nominal dimension:

Lumber: A dimension that may vary from actual dimensions as provided in American Lumber Standard listed in Appendix A.

Masonry: A dimension that may vary from actual masonry dimensions by the thickness of a mortar joint but not to exceed one-half (1/2) inch.

Non-depletable energy sources: Sources of energy (excluding minerals) derived from incoming solar radiation including photosynthetic processes; from phenomena resulting there from including wind, waves and tides, lake or pond thermal differences; and energy derived from the internal heat of the earth, including nocturnal thermal exchanges.

Noncombustible: This is a general, relative term. Its precise meaning is defined in this code for specific applications.

Occupancy: The purpose for which a building, or part thereof, is used or intended to be used.

Occupancy load: The number of individuals normally occupying the building, or part thereof, or for which the exitway facilities have been designed.

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Occupied: As applied to a building, shall be construed as though followed by the words "or intended, arranged or designed to be occupied".

Opaque areas: All exposed areas of a building envelope which enclose conditioned space, except opening for windows, skylights, doors, and building service systems.

Ordinary materials: Materials which do not conform to the requirements of this code for controlled materials.

Outside air: Air taken from the outdoors and, therefore, not previously circulated through the system.

Overall thermal transfer value, (ottv): Overall heat gain through the building wall.

Owner: Every person who alone or jointly or severally with others
(a) has legal title to any building or structure; or
(b) has care, charge, control of any building or structure in any capacity including but not limited to agent, executor, executrix, administrator, administratrix, trustee or guardian of the estate of the holder of legal title; or
(c) lessee under a written letting agreement; or
(d) mortgagee in possession; or
(e) agent, trustee or other person appointed by the courts. Each such person is bound to comply with the provisions of the Basic Code.

Packaged terminal air-conditioner: A factory-selected combination of heating and cooling components, assemblies, or sections, intended to serve a room or zone.

Panel (Part of a structure): The section of a floor or wall comprised between the supporting frame of two (2) adjacent rows of columns and girders or column bands of floor construction.

Party wall: A fire wall on an interior lot line used or adapted for joint service between two (2) buildings.

Penthouse: An enclosed structure above the roof of a building, other than a roof structure or bulkhead, occupying not more than thirty-three and one-third (33-1/3) per cent of the roof area.

Permit: An official document or certificate issued by the authority having jurisdiction authorizing performance of a specified activity.

Person: Every individual, partnership, corporation, firm, association, trustee or group, including a city, town, county, authority or other governmental unit, owning property or conducting any activity regulated by this Basic Code.

Plenum: An air compartment or chamber to which one (1) or more ducts are connected, and which forms part of an air distribution system.

Positive heat supply: Heat supplied to a space by design.

Power: In connection with machines, power is the time rate of doing work. In connection with the transmission of energy of all types, power refers to the rate at which energy is transmitted; in customary units, it is measured in watts (W) or British thermal units per hour (Btu/h).

Prefabricated: Construction materials or assembled units fabricated prior to erection or installation in a building or structure.

Prefabricated building: The completely assembled and erected building or structure, including the service equipment, of which the structural parts consist of prefabricated individual units or subassemblies using ordinary or controlled materials; and in which the service equipment may be either prefabricated or at-site construction.

Prefabricated subassembly: A built-up combination of several structural elements designed and fabricated as an assembled section of wall, ceiling, floor or roof to be incorporated into the structure by field erection of two (2) or more such sub-assemblies.

Prefabricated unit: A built-up section forming an individual structural element of the building, such as a beam, girder, plank, strut, column or truss, the integrated parts of which are prefabricated prior to incorporation into the structure, including the necessary means for erection and connection at the site to complete the structural frame.

Prefabricated unit service equipment: A prefabricated assembly of mechanical units, fixtures and accessories comprising a complete service unit of mechanical equipment, including bathroom and kitchen plumbing assemblies, unit heating and air-conditioning systems and loop wiring assemblies of electric circuits.

Preservative treatment (treated material): Unless otherwise noted, is impregnation under pressure with a wood preservative. Wood preservative is any suitable substance that is toxic to fungi, insects, borers, and other living wood-destroying organisms.

Primary member: Any member of the structural frame of a building or structure used as a column; grillage beam; or to support masonry walls and partitions;

including trusses, isolated lintels spanning an opening of eight (8) feet or more; and any other member required to brace a column or a truss.

Professional engineer or architect: An individual technically and legally qualified to practice the profession of engineering or architecture.

Public way: Any street, alley or other parcel of land open to the outside air leading to a public street, deeded, dedicated, or otherwise permanently appropriated to the public for public use and having a clear width of not less than ten (10) feet.

Reinforced concrete: Concrete in which reinforcement, other than that provided for shrinkage or temperature changes, is combined in such manner that the two (2) materials act together in resisting forces.

Repair: Any maintenance which affects structure, egress, fire protection systems, fire ratings, energy conservation provisions (Article 31), or utilities. A building permit is required.

Repairs, ordinary: Any maintenance which does not affect structure, egress, fire protection systems, fire ratings, energy conservation provisions (Article 31), plumbing, sanitary, gas, electrical or other utilities. A building permit is not required for ordinary repairs.

Reset: Adjustment of the set point of a control instrument to a higher or a lower value, either automatically or manually in order to conserve energy.

Residential unit: In R-3 use group, a room or group of rooms occupied as a single unit.

Resistance, thermal R: A measure of the ability to retard the flow of heat. The R value is the reciprocal of a heat transfer coefficient as expressed by U. $R = 1/U$.

Required: Shall be construed to be mandatory by provisions of this code.

Roof: The roof slab or deck with its supporting members, not including vertical supports.

Roof covering: The covering applied to the roof for weather resistance, fireresistance or appearance.

Roof structure: An enclosed structure on or above the roof of any part of a building.

Room air conditioner: An encased assembly designed as a unit for mounting in a window or through a wall, or as a console. It is designed primarily to provide free delivery of conditioned air to an enclosed space, room or zone. It includes a prime source of refrigeration for cooling and dehumidification and means for circulating and cleaning air, and may also include means for ventilating and heating.

Rubble masonry: Masonry composed of roughly shaped stones.

Secondary member: Any member of the structural framework other than a primary member, including filling-in beams of floor systems.

Sensible heat: Heat added or removed which can be measured by a change in temperature of the substance.

Separate sleeping area: Area or areas of the family living unit in which the bedrooms (or sleeping rooms) are located. Bedrooms (or sleeping rooms) separated by other use areas, such as kitchens or living rooms (but not bathrooms), shall be considered as separate sleeping areas.

Service systems: All energy-using systems in a building that are operated to provide services for the occupants or processes housed therein, including HVAC, service water heating, illumination, transportation, cooking or food preparation, laundering or similar functions.

Service water heating: Supply of hot water for domestic or commercial purposes other than comfort heating.

Service water heating demand: The maximum design rate of heated water withdrawal from a service water heating system in a designated period of time (usually an hour or a day).

Shall: The term, when used in this code, shall be construed as mandatory.

Smoke detector: An approved, listed detector sensing visible or invisible particles of combustion.

Solar energy source: Source of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.

Solid masonry: Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar, or consisting of plain concrete.

Stairway: One (1) or more flights of stairs, and the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one floor to another. A flight of stairs, for the purposes of this article, must have at least three (3) risers.

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State building code: The State Building Code and amendments and rules and regulations thereto as promulgated by the BBRS under Sections sixteen (16), seventeen (17), and eighteen (18) of Chapter twenty-three (23)B of the Massachusetts General Laws Annotated as amended.

State building code commission (SBCC): The Massachusetts State Building Code Commission established by Section sixteen (16) of Chapter twenty-three (23)B of the Massachusetts General Laws Annotated as amended. This Commission has been replaced by the BBRS.

State inspector: An employee of the Division of Inspection, State Department of Public Safety, who is charged with administering and enforcing the Basic Code relative to any structure or building or parts thereof that are owned by the Commonwealth or any departments, commissions, agencies or authorities of the Commonwealth. The state inspector is also charged with supervising the enforcement of the Basic Code relative to all buildings and structures other than those owned by the Commonwealth. (See Section 108.9).

Story: That portion of a building included between the upper surface of a floor and upper surface of the floor or roof next above.

Story (first): The lower-most story entirely above the grade plane.

Street: A public thoroughfare (street, avenue, boulevard) which has been dedicated for public use.

Street lot line: The lot line dividing a lot from a street or other public space.

Structural clay tile: A hollow masonry unit composed of burned clay, shale, fireclay or mixtures thereof, and having parallel cells.

Structural steel member: Any primary or secondary member of a building or structure consisting of a rolled steel structural shape, cold-formed steel, light gage steel or steel joist members.

Structure: A combination of materials assembled at a fixed location to give support or shelter, such as a building, framework, retaining wall, tent, reviewing stand, platform, bin, fence, sign, flagpole, recreational tramway, mast for radio antenna or the like. The word "structure" shall be construed, where the context requires, as though followed by the words, "or part or parts thereof".

System: A combination of equipment and/or controls, accessories, interconnecting means, and terminal elements by which energy is transformed and delivered to

desired areas so as to perform a special function, such as HVAC, service water heating, or illumination.

Thermal resistance R: A measure of the ability to retard the flow of heat. The R value is the reciprocal of the heat transfer coefficient. $R = 1/U$.

Thermal transmittance, U: Coefficient of heat transmission (air to air) expressed in units of Btu per hour per square foot per degree F. It is the time rate of heat flow. The U value applies to combinations of different materials used in series along the heat flow path, single materials used in series along the heat flow path, single materials that comprise a building section, cavity air spaces, and surface air films on both sides of a building element.

Thermal transmittance overall, U_o or overall U_o: Overall (average) heat transmission of a gross area of the exterior building envelope, expressed in units of Btu per hour per square foot per degree F. The U_o value applies to the combined effect of the time rate of heat flows through the various parallel paths, such as windows, doors, and opaque construction areas, comprising the gross area of one or more exterior building components, such as walls, floors, or roof/ceiling.

Thermostat: An instrument which measures changes in temperature, and controls device(s) for maintaining a desired temperature.

Tile: A ceramic surface unit, usually relatively thin in relation to facial area, made from clay or a mixture of clay and other ceramic materials, called the body of the tile, having either "glazed" or "unglazed" face and fired above red heat in the course of manufacture to a temperature sufficiently high to produce specific physical properties and characteristics.

Unitary cooling and heating equipment: One or more factory made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well. Where such equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Unitary heat pump: One or more factory-made assemblies which normally include an indoor conditioning coil, compressor(s) and outdoor coil or refrigerant-to-water heat exchanger, including means to provide both heating and cooling functions. It is designed to provide the functions of air circulation, air cleaning, cooling, and heating with controlled temperature, and dehumidifying, and may optionally include the function of humidifying. When such equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Vent: A conduit or passageway, vertical or nearly so, for conveying products of combustion to the outside atmosphere. Type B and B-W: A gas venting system consisting of vent piping and fittings listed for use with a listed gas appliance.

Type L: A low temperature venting system, consisting of listing vent piping and fittings for use with oil-burning appliances listed for use with Type L vents, or with listed gas appliances.

Vent connector: The pipe used to connect an approved fuel fired appliance to a chimney or vent.

Vent system: A continuous open passageway from the flue collar or draft hood of a fuel burning appliance to the outside atmosphere for the purpose of removing products of combustion.

Ventilation: The process of supplying air to, or removing air from, any space. Such air may or may not have been conditioned.

Ventilation air: That portion of supply air which comes from outdoors, plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

Vertical opening: An opening through a floor or roof.

Wall:

Bearing wall: A wall supporting any vertical load in addition to its own weight.

Cavity wall: A wall built of masonry units or of plain concrete, or a combination of these materials, arranged to provide an air space within the wall, and in which the inner and outer parts of the wall are tied together with metal ties.

Composite wall: A wall built of a combination of two (2) or more masonry units of different materials bonded together, one (1) forming the back-up and the other the facing elements.

Non-bearing wall: A wall which does not support vertical load other than its own weight.

Parapet wall: That part of a wall entirely above the roof line.

Retaining wall: A wall designed to resist the lateral displacement of soil or other material.

ONE AND TWO-FAMILY DWELLING

Veneered wall: A wall having a facing of masonry or other weather-resisting noncombustible materials securely attached to the backing, but not so bonded as to exert common action under load.

Winder: A step in a winding stairway.

Writing: The term shall be construed to include handwriting, typewriting, printing, photo-offset or any other form of reproduction in legible symbols or characters.

Written notice: A notification in writing delivered in person to the individual or parties intended, or delivered at, or sent by certified or registered mail to the last residential or business address of legal record.

Yard: An unoccupied open space.

Zone: A space or group of spaces within a building with heating and/or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

Zoning: The reservation of certain specified areas within a community or city for buildings and structures, or use of land, for certain purposes with other limitations such as height, lot coverage and other stipulated requirements.

SECTION 3401.0 BUILDING PLANNING

3401.1 General: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

3401.1.1 Material and equipment identification: Where practicable, all materials and equipment requiring conformance to this code shall be marked in order to show compliance with the approved plans and specifications.

3401.1.2 Alternate materials, methods of construction, design or insulating systems: The provisions of this article are not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been approved as specified in Section 110.0.

3401.2 Design criteria

3401.2.1 General: One and two-family dwelling structures shall be designed based upon the wind, snow, and live load criteria of Article 11 of the basic code. (30 psf-bedrooms, 40 psf-living areas and 30 psf-roof).

3401.3 Design conditions for energy conservation: The criteria of this section establish the minimum requirements for the thermal design of the exterior envelope of buildings and for HVAC systems and their parts.

3401.3.1 Thermal performance: A building that is designed to be both heated and cooled shall meet the more stringent of the heating or cooling requirements as provided in this article.

3401.3.2 Design parameters: The following design parameters shall be used for calculations required. (See Table 3401-1).

3401.4 Location on lot: Exterior walls of dwellings located less than three (3) feet from property lines shall have not less than one (1) hour fireresistive rating.

3401.4.1 Opening protectives: Openings shall not be permitted in exterior walls of dwellings located less than three (3) feet from the property line.

3401.5 Light and ventilation: All habitable rooms shall be provided with aggregate glazing area of not less than eight (8) per cent of the floor area of such rooms. One-half (1/2) of the required area of glazing shall be openable.

Exception: A combination of natural and mechanical ventilation shall be allowed when evidence is submitted that the combination meets the minimum requirements established in this article.

**TABLE 3401-1
DESIGN TEMPERATURES AND DEGREE DAYS**

City/Town	Heating Degree Days	Heating Degrees F	Cooling Degrees F Dry Bulb	Cooling Degrees F Wet Bulb
Boston	5634	+10	88	74
Clinton	6517	+ 2	85	74
Fall River	5774	+ 9	86	74
Framingham	6144	+ 3	89	74
Lawrence	6195	+ 1	88	74
Lowell	6056	+ 3	89	74
New Bedford	5395	+13	84	73
Pittsfield	7578	+ 1	84	74
Springfield	5844	+ 1	88	74
Taunton	6184	+ 5	86	75
Worcester	6969	+ 1	87	73

3401.5.1 Alcove rooms: When alcove rooms open without obstruction into adjoining rooms, the required window openings to the outer air shall be based on the combined floor area of room and alcove. An alcove space shall be not more than sixty (60) square feet in area and the opening to the adjoining room shall not be less than fifty (50) per cent of the superficial area of the dividing wall, unless provided with separate means of light and ventilation.

3401.5.2 Mechanical ventilation: Ventilation air shall conform to Std. RS-21-12. The minimum value for each type of room use is given in Table 3401-2. The ventilation quantities specified are for one hundred (100) per cent outdoor air ventilating systems. A reduction to thirty-three (33) per cent of the specified outdoor values for recirculating HVAC systems is permitted. In no case shall the outdoor air quantity be less than five (5) cfm per person.

Exception: If outdoor air quantities other than those specified are used or required because of special occupancy requirements or other standards, the required outdoor air quantities shall be used as the basis for calculating the heating and cooling design loads.

Table 3401-2
VENTILATION REQUIREMENTS FOR ONE- AND
TWO-FAMILY DWELLINGS

TYPE OF ROOM	Required Ventilation air in cubic feet per minute per human occupant
General living areas, bedroom	5
Kitchens	20
Baths, toilet rooms	20
Basements, utility rooms	5

Note: If design occupancy is not known, ventilation is to be based upon an estimate of five (5) persons per one thousand (1,000) square feet of floor area.

3401.5.2.1 Natural ventilation: In a bathroom, if a window is available which is unrestricted and opens directly to the outer air, no mechanical ventilation shall be necessary.

3401.6 Room dimensions

3401.6.1 Ceiling heights: Habitable (space) rooms, other than kitchens, storage rooms and laundry rooms shall have a ceiling height of not less than seven (7) feet three (3) inches. Hallways, corridors, bathrooms, water closet rooms, and kitchens shall have a ceiling height of not less than seven (7) feet measured to the lowest projection from the ceiling.

If any room in a building has a sloping ceiling, the prescribed ceiling height for the room is required in only one-half (1/2) the area thereof. No portion of the room measuring less than five (5) feet from the finished floor to the finished ceiling shall be included in any computation of the minimum area there of.

If any room has a furred ceiling, the prescribed ceiling height is required in two-thirds (2/3) of the area thereof, but in no case shall the height of the furred ceiling be less than seven (7) feet.

3401.6.2 Floor area: Habitable rooms except kitchens shall have an area of not less than seventy (70) square feet between enclosing walls or partitions, exclusive of closet and storage spaces.

3401.6.3 Width: No habitable room other than a kitchen shall be less than seven (7) feet in any dimension.

Exception: Beams and girders spaced not less than six (6) feet on center may project not more than seven (7) inches below the required average ceiling height.

3401.7 Glazing

3401.7.1 Human impact loads: Individual glazed areas in hazardous locations such as those indicated in Section 3401.7.2 shall comply with the requirements of the ANSI Z97.1 standard listed in RS-21-2, or by comparative test shall be proven to produce at least equivalent performance. Annealed glass shall not be used.

3401.7.2 Specific hazardous locations: The following shall be considered specific hazardous locations for purposes of glazing:

1. glazing in ingress and egress doors;
2. glazing in fixed and sliding panels of sliding type doors (patio and mall type);
3. glazing in storm doors;
4. glazing in all unframed swinging doors;
5. glazing in shower doors and tub enclosures;
6. glazing in fixed panels within sixty (60) inches horizontally of the nearest vertical edge of the ingress and egress door;
7. glazing in fixed panels with a bulkhead less than thirty six (36) inches above the finish floor level which because of their size or design may be mistaken as a means of ingress or egress; and
8. glazing closer to the floor than eighteen (18) inches and exceeding six (6) square feet in area.

3401.8 Sanitation: Every dwelling unit shall meet the requirements of the Department of Public Health and the Massachusetts State Plumbing Code (248 CMR 2.00) relative to sanitation.

3401.9 Private garages

3401.9.1 Openings: There shall be no openings from a private garage directly into a room used for sleeping purposes. Other openings between the garage and residence shall be equipped with doors providing a fire rating equivalent to twenty (20) minutes.

3401.9.2 Fire protection: The garage shall have five-eighths(5/8) inch gypsum board on the garage side of wall or floor adjacent to the house, and wherever the attic area is continuous between the garage and the house a firestop of one-half(1/2) inch gypsum board shall be used to form a barrier to separate the garage and house.

3401.9.3 Flooring: Garage and carport floor surfaces shall be approved nonabsorbent, noncombustible material.

3401.9.4 Floor level: The floor level of all door openings between the garage and the dwelling shall have either a mini-mum four (4) inch raised sill or the floor shall have a ramp or floor pitched a minimum of five (5) per cent in the direction of the overhead garage doors.

3401.10 Egress

3401.10.1 Means of egress: In one- and two-family dwellings,each dwelling unit shall have two (2) independent means of egress, remote as possible from each other and leading to grade; in addition, every floor within a dwelling unit shall have at least one (1) means of egress which shall provide a continuous and unobstructed path leading to grade.

3401.10.2 Egress doors: Access to grade at termination of the required means of egress may be provided by the use of both side-hinged swinging doors or sliding glass doors. Swinging doors provided to meet this requirement may swing inward.

3401.10.3 Emergency egress: Sleeping rooms shall have at least one (1) openable window or exterior door to permit emergency egress or rescue. A required window must be openable from the inside without the use of separate tools, and shall conform to the following:

1. the sill height shall be not more than forty-four (44) inches above the finish floor;
2. shall provide a minimum net clear opening area of 3.3 square feet with a rectangle having minimum net clear opening dimensions of twenty (20) inches by twenty-four (24) inches, in either direction. If a double hung unit is used, then such dimensions shall apply to the bottom half.

3401.10.4 Doorways and hallways

3401.10.4.1 Interior doorways: The minimum nominal width of any interior doorway, except in closets, storage areas and bathrooms, shall be two (2) feet six

(6) inches. There shall be no minimum requirement for doorway width in closets, storage areas and bathrooms.

3401.10.4.2 Exitway doorways: The minimum nominal width of every required exitway doorway to or from a stairway shall be thirty-six (36) inches.

Exception: Second means of egress doorways may be thirty-two (32) inches.

3401.10.4.3 Nominal height: The minimum nominal height of required egress doorways shall be six (6) feet six (6) inches.

3401.10.4.4 Exitway access: The minimum clear width of a hallway or exitway access shall be three (3) feet.

3401.10.4.5 Door hardware: Double cylinder dead bolts requiring a key operation on both sides are prohibited on required means of egress doors serving more than one dwelling unit.

3401.10.5 Landings: A landing shall be provided on each side of an egress door. The interior floor or landing shall not be more than two (2) inches lower than the threshold of the door-way. Where doors open over landings, the landings shall have a minimum width and depth of three (3) feet.

Exception: A landing is not required where the exit door does not swing over the stair.

3401.10.6 Door swing: A door may open at the top of a flight of stairs provided the door does not swing over the top step and the top step is not more than seven and one-half (7-1/2) inches below the threshold level.

3401.10.7 Accessory doors: Storm, screen or other doors accessory to exit doors which swing over stairs shall require a landing where they swing in the direction of the stairs. The landing shall be not more than seven and one-half (7-1/2) inches below the threshold level.

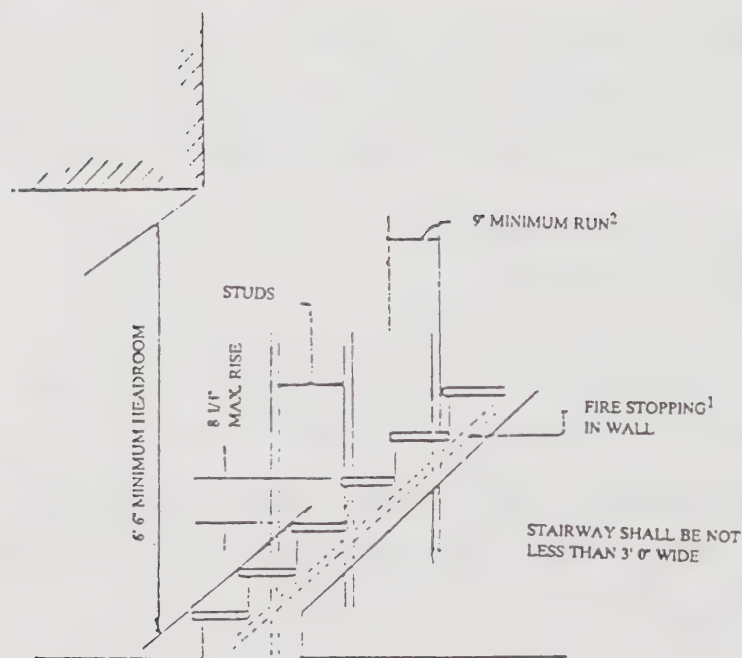
3401.10.8 Stairways: Required egress stairways shall be not less than three (3) feet in clear width. Headroom, rise and run shall conform to Figure 3401-1. Minimum headroom for basement cellar and service stairs shall be six (6) feet six (6) inches. Handrails may project from each side of a stairway a distance of three and one-half (3-1/2) inches into the required width.

3401.10.8.1 Loading: Stairways and landings shall provide for safe ascent and descent under normal and emergency conditions and for the transport of furniture and equipment.

3401.10.8.2 Spiral stairways: Spiral stairways may be used as an element of a means of egress within a single dwelling unit. The minimum width of tread shall be twenty-six (26) inches with each tread having a seven and one-half (7-1/2) inch minimum tread width at twelve (12) inches from the narrow edge. All treads shall be identical and the rise shall be not more than nine and one-half (9-1/2) inches. A minimum head-room of six and one-half (6-1/2) feet shall be provided.

3401.10.8.3 Winders: Winders may be used as an element of a means of egress, provided the width of the tread, at a point not more than eighteen (18) inches from the side where the treads are narrower, is not less than nine (9) inches.

**Figure 3401-1
STAIR DETAIL**



Note 1: Indicates Firestopping as the dotted lines parallel to the stair stringers.

Note 2: Nosing not to exceed one and one-quarter (1-1/4) inches.

3401.11 Handrails and guardrails: Handrails having minimum and maximum height of thirty (30) inches and thirty-four (34) inches, respectively, measured vertically from the nosing of the treads shall be provided on at least one (1) side of stairways of three (3) or more risers. Open sides of all stairs shall be similarly protected by guards. However, handrails shall not be required on stairways with three (3) or more risers where the raised platform to which they lead is thirty (30) inches or less above the floor or grade.

3401.11.1 Other guardrails: Porches, balconies or raised floor surfaces located more than thirty (30) inches above the floor or grade below shall have guardrails not less than thirty-six (36) inches in height.

3401.11.2 Details: Guards shall be constructed so that the area in the plane of the guard, from the top of the tread to the top of the guard, is subdivided or filled in one (1) of the following methods:

1. a sufficient number of intermediate longitudinal rails constructed so that the clear distance between rails (measured at right angles to the rail) does not exceed nine(9) inches. The bottom rail shall not be more than nine(9) inches (measured vertically) from the tread nosing; or
2. balusters spaced not more than nine (9) inches apart; or
3. panels of wire mesh, or expanded metal, or ornamental grills which provide protection equivalent to that provided by the intermediate rails or balusters specified in the two(2) preceding paragraphs; or
4. walls; or
5. any combination of the foregoing.

3401.12 Gutters and downspouts: When a city or town requires by ordinance or by-law, run-off control, then the pro-visions of Sections 3401.12.1 and 3401.12.2 shall apply.

3401.12.1 Minimum size of gutters: Gutters shall have the same area as downspouts for spacings up to forty (40) feet between downspouts. The width of the gutter shall be increased by one(1) inch for each additional twenty (20) feet of gutter.

3401.12.2 Downspouts: Downspouts shall be sized on the basis of approximately one hundred (100) square feet of roof surface to one (1) square inch leader.

3401.13 Flame spread for walls and ceilings

3401.13.1 Flame spread: All room, wall and ceiling finishes shall have a flamespread classification of not greater than two hundred 200 as tested in accordance with ASTM E84.

Exception: Flamespread requirements are not applicable to bathrooms.

3401.14 Fire protection

3401.14.1 Smoke detectors: All buildings which are defined by this code as one or two-family dwellings, including manufactured homes, shall contain a Type III system in conformance with 3401.14.1.1 of this section with smoke detectors located as herein required and installed in conformance with NFIPA 74.

3401.14.1.1 Type III system: A Type III system shall be installed in accordance with NFIPA 74. Power shall be supplied from a permanently wired connection directly to an A.C. primary source of power or monitored batteries. All power for A.C. powered detectors shall be taken from a single branch circuit which also provides other electrical service to a habitable area; and the power source for the detectors shall be on the supply side, ahead of any switches. All required smoke detectors shall be provided with a visible power-on indication. All required smoke detectors shall be inter-connected so that when one actuates, all will sound to meet the requirements of NFIPA 74, Section 2-2.4. All required smoke detectors shall conform to Section 3401.14.3.

3401.14.2 Location: Smoke detectors shall be located to comply with the following minimum requirements:

1. Minimum number of detectors:

- a. No less than one (1) approved smoke detector shall be provided on the highest habitable level and on each floor, story or level below, including basements or cellars.
- b. For any floor, level or story exceeding twelve hundred(1200) square feet in area, one (1) approved smoke detector shall be provided for each twelve hundred(1200) square feet or part thereof.

2. Location of detectors:

- a. One (1) approved smoke detector shall be located outside of each separate sleeping area, in accordance with the definition of "Separate Sleeping Area".
- b. One (1) approved smoke detector shall be located on the ceiling near the base of, but not within, each stairway.

3. Combined coverage: Smoke detectors required by item 2-a of this section may be used to fulfill the requirements of item 2-b of this section.

3401.14.3 Approved devices: Single station and multiple station smoke detection devices: Smoke detectors of single station and multiple station types shall meet the requirements of U.L. 217 and be listed or approved by a nationally recognized fire testing laboratory.

3401.14.4 Maintenance and testing:

1. It shall be the responsibility of the owner to properly maintain the system.

3401.15 Building in a flood plain: Where a structure is located in a flood plain or coastal high hazard area as determined by the building official or the governmental body having jurisdiction, such a structure must be designed to resist or overcome the anticipated flood conditions in accordance with the provisions of Section 3402.0.

3401.16 Fire separation: The requirements for the construction of fire separation walls in buildings containing single-family dwellings or two-family dwellings (use group R-3 or R-4) are as follows:

1. **Two-family dwelling, superimposed dwelling units:** When one(1) dwelling unit of a two-family dwelling is located wholly or partly above the other dwelling unit, the two(2) dwelling units shall be completely separated by fire separation walls and floor-ceiling assemblies of not less than one (1) hour fireresistance rated construction.
2. **Two-family dwelling, side-by-side dwelling units:** When adjacent dwelling units of a two-family dwelling are attached by a common wall, said wall shall be a fire separation wall, having a minimum one (1) hour fire-resistance rating that shall serve to completely separate the dwelling units.
3. **Multiple single-family dwellings, side-by-side:** When multiple single-family dwellings (use group R-3) are attached by a common wall, said wall shall be a fire separation wall, having a minimum one (1) hour fire-resistance rating. Said wall shall extend from the foundation to the underside of the roof sheathing, and to the inside of the exterior wall sheathing.
4. **Multiple two-family dwellings; side-by-side:** When a multiple two-family dwellings (use group R-3) are attached by a common wall, said wall shall be a fire separation wall, having a minimum one (1) hour fire-resistance rating. Said wall shall extend from the foundation to the underside of the roof sheathing and to the inside of the exterior wall sheathing.

SECTION 3402.0 FOUNDATIONS

3402.1 General: Foundations, footings and basement walls shall be constructed in accordance with the requirements of this section.

3402.2 Materials: Conformity with the applicable standards specified in the reference standards of this Article shall be acceptable as providing compliance with the requirements of this Article.

3402.2.1 Compressive strength: The ultimate compressive strength of concrete foundations at twenty-eight (28) days shall be not less than two thousand (2,000) pounds per square inch except where weather exposure requires a greater strength or cement content.

3402.3 Footings: All exterior walls, bearing walls, columns and piers shall be supported on solid masonry, or concrete footings, or other approved structural systems which shall be of sufficient design to support safely the loads imposed as determined from the character of the soil.

3402.3.1 Grade clearance: Foundation walls shall extend at least eight (8) inches above the finished grade adjacent to the foundation at all points, except where otherwise approved by the building official.

3402.3.2 Foundations on sloping grade: Foundations for all buildings where the surface of the ground slopes more than one (1) foot in ten (10) feet shall be level or shall be stepped so that both top and bottom of such foundations are level.

3402.3.3 Unformed foundation walls: Unformed foundation walls may be used when soil conditions warrant, subject to the approval of the building official.

3402.3.4 General: Footings of adequate size shall be provided when necessary to properly distribute the load within the allowable bearing pressure of the soil. All permanent supports of buildings and structures shall extend a minimum of four (4) feet below finished grade except when erected upon sound bedrock or when protected from frost, or when the foundation grade is established by a registered professional engineer and is approved by the building official. The engineer shall support the design grade with data including the type and extent of free-draining foundation material, ground water levels, and climatic records.

3402.4 Basement walls: Basement walls shall be constructed in accordance with the provisions of this section and in accordance with accepted practice.

3402.4.1 Masonry and concrete walls: Where unstable soil or ground water conditions do not exist, walls may be constructed of unreinforced masonry or concrete with the thickness shown in Table 3402-1.

3402.4.1.1 Reinforced masonry or concrete: Where unstable soil conditions exist or in seismic zones specified by the BBRS, basement walls may be constructed of reinforced masonry or concrete as set forth in Table 3402-1 provided the walls are not subjected to equivalent fluid pressures of more than thirty (30) pounds per square foot.

Exception: Basement walls retaining less than four (4) feet of unbalanced fill need not be reinforced.

3402.4.2 Design and Installation:

1. Basement walls subjected to more than thirty (30) pounds per square foot equivalent fluid pressure shall be de-signed in accordance with accepted engineering practices.
2. Backfill adjacent to the wall shall not be placed until the wall has sufficient strength or has been sufficiently braced to prevent damage by the backfill.
3. Basement walls shall be drained and dampproofed in accordance with Section 3402.5 and Section 3402.6 respectively.

3402.5 Waterproofing: Drains shall be provided around con-crete and masonry foundations enclosing habitable or usable spaces located below grade and which are subjected to groundwater conditions. Drains shall be installed at or below the area to be protected and shall discharge by gravity or by mechanical means into an approved drainage system.

3402.5.1 Drainage tile protections: The top joints and perforations of drain tiles shall be protected with strips of building paper and the tiles shall be placed on two (2) inches of crushed rock and covered with not less than six (6) inches of the same material.

3402.6 Dampproofing: Exterior foundation walls of masonry construction enclosing basements shall be dampproofed by applying not less than three-eighths (3/8) inch of portland cement parging to the wall from footing to finish grade. The parging shall be covered with a coat of approved bituminous material applied at the recommended rate. Exterior foundation walls of concrete construction enclosing basements shall be dampproofed by applying a coat of approved bituminous material to the wall from the footing to the finish grade at the recommended rate.

3402.6.1 Concrete and masonry: Foundation walls of habitable rooms located below grade shall be waterproofed with membranes extending from the edge of

the footing to the finish grade line. The membrane shall consist of either two (2) ply hot-mopped felts, six (6) mil polyvinyl chloride, fifty-five (55) pound roll roofing or equivalent material. The laps in the waterproofing membrane shall be sealed and firmly affixed to the wall.

3402.6.2 Other methods: Basement walls may be dampproofed or waterproofed using materials or methods of construction other than covered in the section when approved by the building official.

3402.7 Foundation knee walls: Studs shall have a minimum length of fourteen (14) inches and shall be not less in size and spacing than the studding required for exterior walls, and when exceeding four (4) feet in height shall be of the size required for an additional story.

3402.7.1 Kneewall bracing: Foundation kneewall studs of exterior walls and bearing partitions shall be thoroughly and effectively cross-braced (see Table 3403.3).

3402.8 Protection against decay and termites

3402.8.1 Wood in contact with the ground: All wood in contact with the ground and supporting permanent structures shall be approved treated wood. All wood below two (2) inches above surrounding grade, or in locations subject to ponding of water and/or dampers shall be of approved wood type or treated (pressure).

3402.8.2 Untreated wood: Untreated wood may be used where entirely below ground water level or continuously submerged in fresh water; and may be used in contact with the ground for detached accessory buildings not intended for human occupancy, for temporary structures, and for fences.

3402.8.3 Wood joists or the bottom of wood structural floors: When wood joists or the bottom of wood structural floors without joists are closer than eighteen (18) inches, or wood girders are closer than twelve (12) inches, to exposed ground located within the periphery of the building over crawl spaces or unexcavated areas, they shall be approved durable or treated wood. Ventilation shall be provided as required in Section 3402.9.

3402.8.4 Sills: All sills which rest on concrete or masonry exterior walls and are less than eight (8) inches from exposed earth shall be approved durable or treated wood.

3402.8.5 Wood posts or columns: Posts or columns in cellars shall be supported by piers projecting at least two (2) inches above the finish floor and

separated therefrom by an approved impervious barrier except when approved durable or treated wood is used. Posts or columns used in damp locations below grade shall be of approved durable or treated wood.

3402.8.6 Wall pockets: Ends of wood girders entering masonry or concrete walls shall be provided with a one-half (1/2) inch air space on top, sides and end, unless approved durable or treated wood is used.

3402.8.7 Clearance between wood siding: Clearance between wood siding and earth on the exterior of a building shall be not less than six (6) inches.

3402.8.8 Wood used in a retaining wall: Wood used in a retaining wall shall be approved durable or treated wood, except as follows:

1. when the wall is not more than two (2) feet in height and is located on the property line; or
2. when the wall is not more than four (4) feet in height and is separated from the property line by a minimum distance equal to the height of the wall.

**TABLE 3402-1
MINIMUM THICKNESS AND ALLOWABLE DEPTH OF
UNBALANCED FILL FOR UNREINFORCED MASONRY
AND CONCRETE WALLS WHERE UNSTABLE
SOIL OR GROUND WATER CONDITIONS DO NOT EXIST**

Foundation Wall Construction	Nominal Thickness (inches)	Maximum depth of unbalanced fill (feet) Type of Superstructure		
		Wood Frame	Masonry Veneer	Veneer
Masonry of Hollow Units	8	4 (6)	4.5 (6)	5 (7)
	10	5 (7)	5.5 (7)	6 (7)
	12	7	7	7
Masonry of Solid Units	6	3	4	4
	8	5 (7)	5.5 (7)	6 (7)
	10	6 (7)	6 (7)	6.5 (7)
	12	7	7	7
Plain Concrete	6 ²	4	4	4
	8	7	7	7
	10	7	7	7
	12	7	7	7
Rubble Stone	Note 3	Note 3	Note 3	Note 3

Notes to Table 3402-1 on following page

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Notes to Table 3402-1:

Note 1: The depth of unbalanced fill may be increased up to the values shown in parentheses where it is warranted by soil conditions. Unbalanced fill is the height of outside finish grade above the basement floor or inside grade.

Note 2: Six (6) inch plain concrete walls shall be formed both sides.

Note 3: Foundation walls of rubble stone shall be at least sixteen (16) inches thick. Rough or random rubble shall not be used as foundations for walls exceeding thirty-five (35) feet in height.

TABLE 3402-2
REINFORCEMENT REQUIRED FOR BASEMENT WALLS SUBJECTED TO NOT
MORE THAN 30 POUNDS PER SQUARE FOOT EQUIVALENT FLUID
PRESSURE

Material Type	Height of Unbalanced Fill (ft)	Length of Wall Between Supporting Masonry or Concrete Walls (ft)	Minimum Wall Thickness (inches)	Horizontal Bar in Upper 12" of Wall	Size & Spacing of Vertical Bars
Hollow Masonry	4 or less	unlimited	8	not req.	not req.
	more than 4	design req.	des. req.	des. req.	design req.
Concrete or Solid Masonry	4 or less	unlimited	8	not req.	not req.
	more than 4	less than 8	8	2 - No. 3	No.3-18"oc
	8 or less	8 to 10	8	2 - No. 4	No.3-18"oc
	8 or less	10 to 12	8	2 - No. 5	No.3-18"oc
	more than 8	design req.	des. req.	des. req.	design req.

Note 1: Thickness of concrete walls may be six (6) inches provided reinforcing is placed not less than one (1) inch nor more than two (2) inches from the face of the wall not against the earth.

Note 2: Solid masonry shall include solid brick or concrete units and hollow concrete units with all cells grouted.

Note 3: Backfilling shall not be commenced until after the wall is anchored to the floor.

3402.8.9 Where approved durable or treated woods are required:

Where approved durable or treated woods are required in this code, the building official shall require identification by an approved mark or certificate of inspection. All lumber and plywood required to be preservatively treated shall bear an approved quality mark of an inspection agency that maintains continuing control, testing and inspection over the quality of the product.

3402.8.10 Pressure treatment: Where pressure treatment of wood members is required by this code, preservations and methods of treatment shall conform to the standards for pressure treatment and preserving of lumber listed in Reference Standard RS-34-4.

3402.9 Underfloor space ventilation

3402.9.1 General: The space between the bottom of the floor joists and the earth under any building (except such space as is occupied by a basement or cellar) shall be provided with a sufficient number of ventilating openings through foundation walls or exterior walls to insure ample ventilation, and such openings shall be covered with a corrosion-resistant wire mesh not greater than one-half (1/2) inch nor less than one-quarter(1/4) inch in any dimension. The minimum total area of ventilating openings shall be proportioned according to Section 3421.2. Vents shall be located to provide cross-ventilation.

Exception: Ventilation openings may be omitted when crawl space is used as a plenum.

3402.9.2 Access: An access crawl hole eighteen (18) inches by twenty-four (24) inches shall be provided to the underfloor space.

3402.9.3 Vegetation and organics: The underfloor grade shall be cleaned of all vegetation and organic material.

3402.9.4 Thermal performance: Floor sections over areas exposed to outside air shall meet the criteria for thermal transmittance specified in Table 3423-1.

SECTION 3403.0 WALL CONSTRUCTION

3403.1 General: Wall and partition construction shall conform to the requirements of this section.

3403.1.1 Specifications: Conformity with the applicable grading, material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this section.

3403.1.2 Energy conservation requirements: Exterior walls shall meet the thermal transmittance requirements as specified in Table 3423-1.

3403.2 Wood

3403.2.1 Identification: All load-bearing lumber, plywood and particleboard shall conform to applicable standards or grading rules and shall be so identified by the grade mark, or certificate of inspection issued by an approved grading or inspection bureau or agency.

3403.2.2 Grade: All headers and studs shall be at least of No. 2, Standard or Stud Grade Lumber or equivalent.

Exceptions:

1. Bearing studs not supporting floors may be No. 3 or Utility Grade or equivalent provided the studs are spaced not more than sixteen (16) inches on center.
2. Nonbearing studs may be of No. 3 or Utility Grade or equivalent lumber.

3403.2.3 Construction: Exterior walls of wood frame residential buildings shall be constructed in accordance with Figures 3403-1 and 3403-2, and Tables 3403-2 and 3403-3.

3403.2.4 Engineering design: Exterior walls subject to wind pressure greater than thirty (30) pounds per square foot, as established in this code shall be designed in accordance with accepted engineering practice.

3403.2.5 Cutting and notching: It shall be unlawful to notch, cut or pierce wood beams, joists, rafters or studs in excess of the limitations herein specified unless proven safe by structural analysis, or suitably reinforced to transmit all calculated loads. Notches in the top or bottom of joists shall not exceed one-sixth ($1/6$) the depth of the member and shall not be located in the middle of one-third ($1/3$) of the span. Notches located closer to the supports than three (3) times the depth of the member shall not exceed one-fifth ($1/5$) the depth. Holes bored or cut into joists for piping or electrical cables shall not be closer than two (2) inches to the top or bottom of the joist and the diameter of the hole shall not exceed one-third ($1/3$) the depth of the joist. In studs of bearing walls or partitions, notches or bored holes made to receive piping, electrical conduit, air-conditioning or heating duct work or for other fabricating purposes shall not be cut or bored more than one-third ($1/3$) the depth of the stud. When the stud is cut or bored in excess of one-third ($1/3$) its depth, it shall be reinforced to be equal in load-carrying capacity to a stud notched not more than one-third ($1/3$) its depth.

3403.2.6 Headers: The allowable span for headers in bearing walls shall not exceed the values set forth in Table 3403-4.

3403.2.7 Firestopping: Firestopping shall be provided to cutoff all concealed draft openings (both vertical and horizontal) and form an effective fire barrier between stories, and between a top story and the roof space. It shall also be used in:

1. stud walls at ceilings and floor levels; and
2. in walls parallel to stair stringers; and
3. any other locations not specifically mentioned above, such as holes for pipes, shafting, behind furring strips, and similar places which could afford a passage for flames.

3403.2.7.1 Dimensions: Firestopping shall consist of approved noncombustible materials or of wood two (2) inches nominal thickness or three-quarter 3/4" plywood. If width of opening is such that more than one (1) piece of lumber is necessary, there shall be two (2) thicknesses of one (1) inch nominal material with staggered joints.

3403.3 Native lumber: Native lumber, as defined in this code, shall be acceptable for use in one and two-story dwellings, barns, sheds, agricultural and accessory structures. Native lumber shall also be acceptable for use in other structures of less than three (3) stories as columns when the design loads are twenty-five (25) per cent greater than required elsewhere by this code; as joists, principal beams, and girders in floor constructions when the design loads are fifteen (15) per cent greater than required elsewhere by this code; and as other elements when the design loads are as required elsewhere by this code.

Each piece of native lumber produced shall be stamped with the name and registration number of the producer in accordance with the rules and regulations of the State Building Code Commission. In addition, all native lumber shall bear an approved mark identifying the species of wood. In lieu of the stamp bearing the name and registration number and species identification, a certification bearing the same information may be provided by the producer for pre-cut or remanufactured lumber in accordance with the rules and regulations of the BBRS. When native lumber is used, it shall be subject to the following requirements:

1. **Sizing criteria:** For lumber sized in accordance with the American Softwood Lumber Standard PS-20-70, figures for maximum fiber stress and modulus of elasticity for framing grade No. 2 will be used in establishing span and spacing characteristics for all structural members.

2. **Stress increases:** Lumber which is sized in excess of the dimensions established by the American Softwood Lumber Standard PS-20-70 for the given nominal size referenced shall be allowed to have a maximum fiber stress increase above that provided in Item 1 above in proportion to the increased bearing capacity of the cross-section as provided in Table 3403-1 or as calculated.

3403.4 Metal: Steel structural elements in walls and partitions may be either hot rolled structural steel shapes or bar sections or members cold formed to shape from steel sheet, strap or plate, or a fabricated combination thereof. Members shall be straight and free of any defects which would significantly affect their structural performance. The allowable span for steel headers in bearing walls shall not exceed the values set forth in Table 3403-4.

3403.4.1 Aluminum materials: Aluminum structural elements in walls and partitions shall be constructed of materials and designed in accordance with accepted engineering practice.

3403.5 Masonry construction: For additional information on masonry construction, see Article 14 of the basic code.

3403.5.1 Corbelling: Corbels may be built only into solid masonry walls twelve (12) inches or more in thickness. The projection for each course in such corbel shall not exceed one-third($1/3$) of total thickness of the wall when used to support structural members, and not more than six (6) inches when used to support a chimney built into the wall. The top course of all corbels shall be a header course.

3403.5.2 Combined units: In walls or other structural members composed of different kinds or grades of units, materials, or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination units, materials, and mortars of which the member is composed. The net thickness of any facing unit which is used to resist stress shall be not less than one and one-half ($1-1/2$) inches.

3403.5.3 Stack bond: In unreinforced masonry where masonry units are laid in stack bond, longitudinal reinforcements consisting of not less than two (2) continuous wires each with a minimum aggregate cross-sectional area of .017 square inch shall be provided in horizontal bed joints spaced not more than sixteen (16) inches on center vertically.

3403.5.4 Unsupported height: The unsupported height of masonry walls shall not exceed the values set forth in Table 3403-6. The unsupported height shall be measured between points of anchorage. Footings may be considered as points of lateral support.

Where wall stability is provided by intersecting walls or vertical stiffening elements such as pilasters, the unsupported length may be measured between these elements providing the stiffening elements are anchored to the roof and floor with connectors capable of transmitting all tributary wind and seismic forces.

3403.5.5 Lintels: Masonry walls shall be reinforced over openings in accordance with Table 3403-7. Exceptions are allowed when an engineering analysis using standard accepted practice is provided to justify variations from the table below.

3403.5.5.1 Reinforcement: The reinforcement shall be located in spaces fully grouted to a depth of not less than eight (8) inches and shall extend not less than twelve (12) inches beyond the sides of the opening.

3403.5.6 Beam supports: Beams, girders or other concentrated loads supported by a wall or column shall have bearing of at least three (3) inches in depth measured parallel to the beam and three (3) inches in length upon solid masonry or upon a metal bearing plate of adequate design and dimensions to distribute the load safely,

or upon a continuous reinforced masonry member projecting not less than four (4) inches from the face of the wall.

3403.5.6.1 Joists shall be supported in accordance with accepted engineering practice.

3403.6 Hollow unit masonry

3403.6.1 General: Hollow unit masonry shall be laid with full face shell mortar beds and head and end joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells. For details, see Article 14 of the basic code.

3403.7 Solid masonry

3403.7.1 General: In each wythe of plain solid masonry, not less than seventy-five (75) percent of the units in any vertical plane perpendicular to the wall plane shall lap the ends of the units above and below a distance not less than one and one-half (1-1/2) inches or one-half (1/2) the height of the units, which-ever is greater, or the masonry shall be reinforced longitudinally. For details, see the applicable reference standards and Article 14 of the basic code.

3403.8 Cavity wall masonry

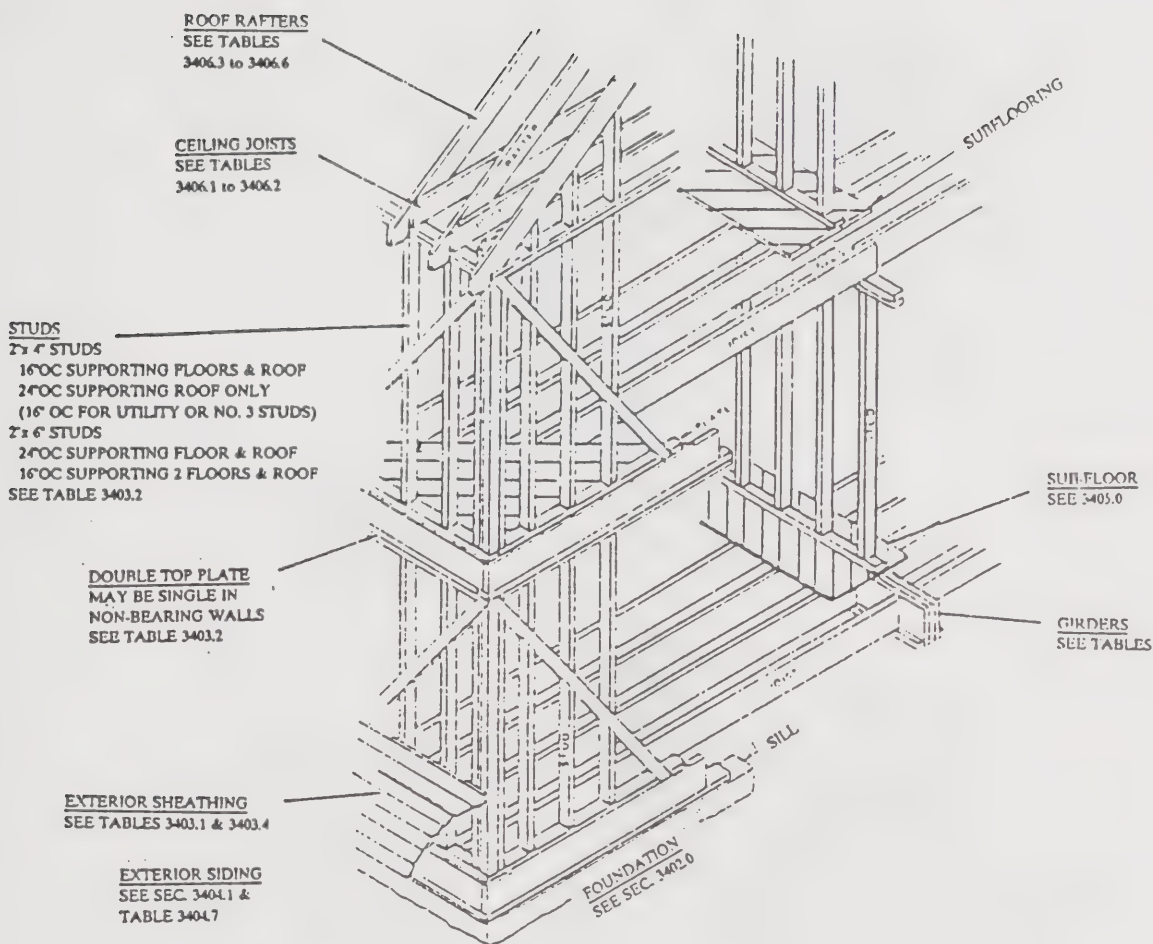
3403.8.1 General: Cavity wall masonry is that type of construction made with brick, structural clay tile or concrete masonry units or any combination of such units in which facing and backing are completely separated except for the metal ties which serve as bonding. For details, see the applicable reference standards and Article 14 of the basic code.

3403.8.2 Reinforcing: The facing and backing of cavity walls shall be bonded with three-sixteenths (3/16) inch diameter steel rods or metal ties of equivalent strength and stiffness embedded in the horizontal joints. There shall be one (1) metal tie for not more than each four and one-half (4-1/2) square feet of wall area for cavity widths up to three and one-half (3-1/2) inches net in width. Where the cavity exceeds three and one-half (3-1/2) inches net in width, there shall be one (1) metal tie for not more than three (3) square feet of wall area. Ties in alternate courses shall be staggered and the maximum vertical distance between ties shall not exceed twenty-four (24) inches and the maximum horizontal distance shall not exceed thirty-six (36) inches. Rods bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical; in other walls the ends of ties shall be bent to ninety (90) degree angles to provide hooks not less than two (2) inches long. Additional bonding ties shall be provided at all openings, spaced not more than three (3) feet apart around the perimeter and within twelve (12) inches of the opening. Ties shall be of corrosion-resistant metal, or shall be coated with a corrosion-resistant metal or other approved protective coating.

3403.9 Grouted masonry

3403.9.1 General: At the time of laying, all masonry units shall be free of excessive dust and dirt. Only Type M and Type S mortar consisting of a mixture of portland cement, hydrated lime and aggregate shall be used. For details, refer to the applicable reference standards and Article 14 of the basic code.

Figure 3403-1
PLATFORM FRAME CONSTRUCTION
 (See Reference Standard for Other Framing Methods)



**Figure 3403-2
INTERIOR PARTITIONS**

Bearing - Same as Exterior Wall

Non-Bearing - Spacing based on limiting span of covering material

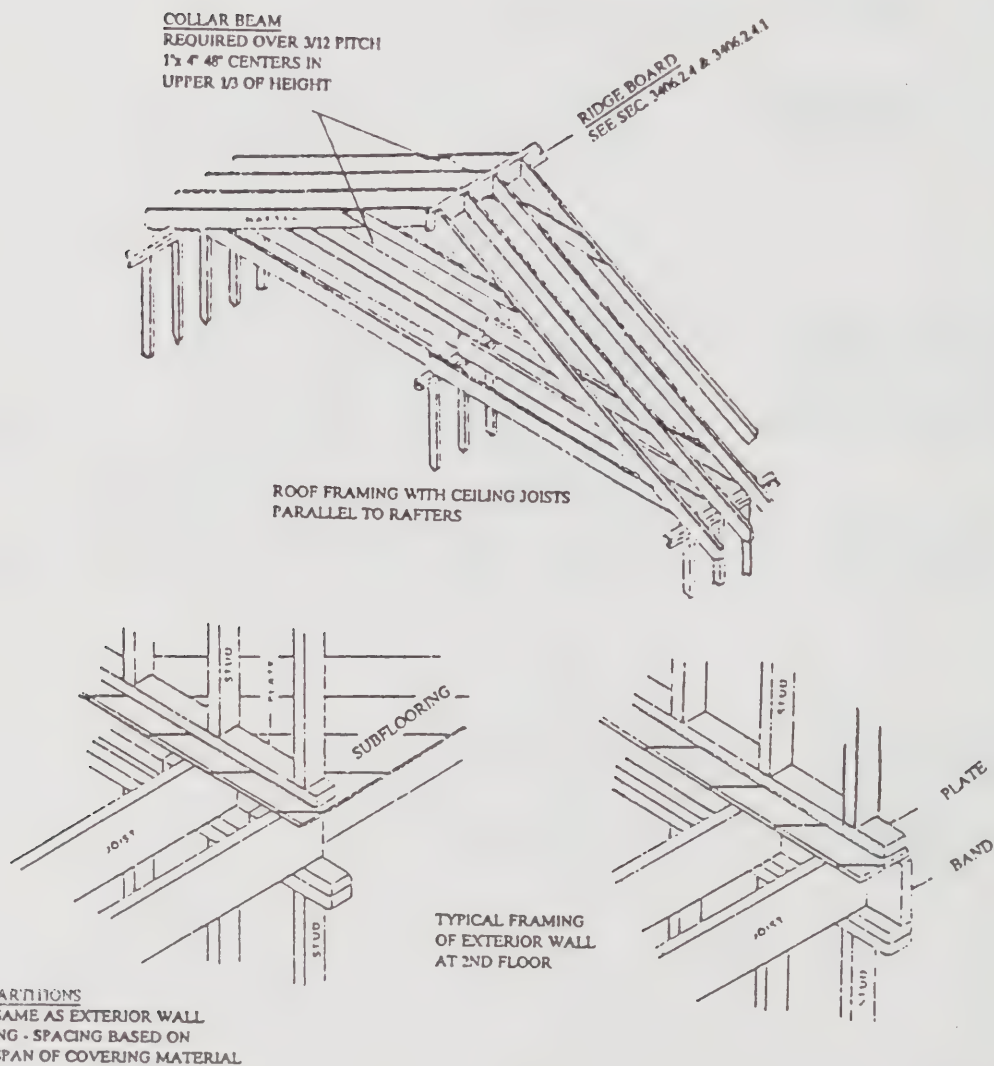
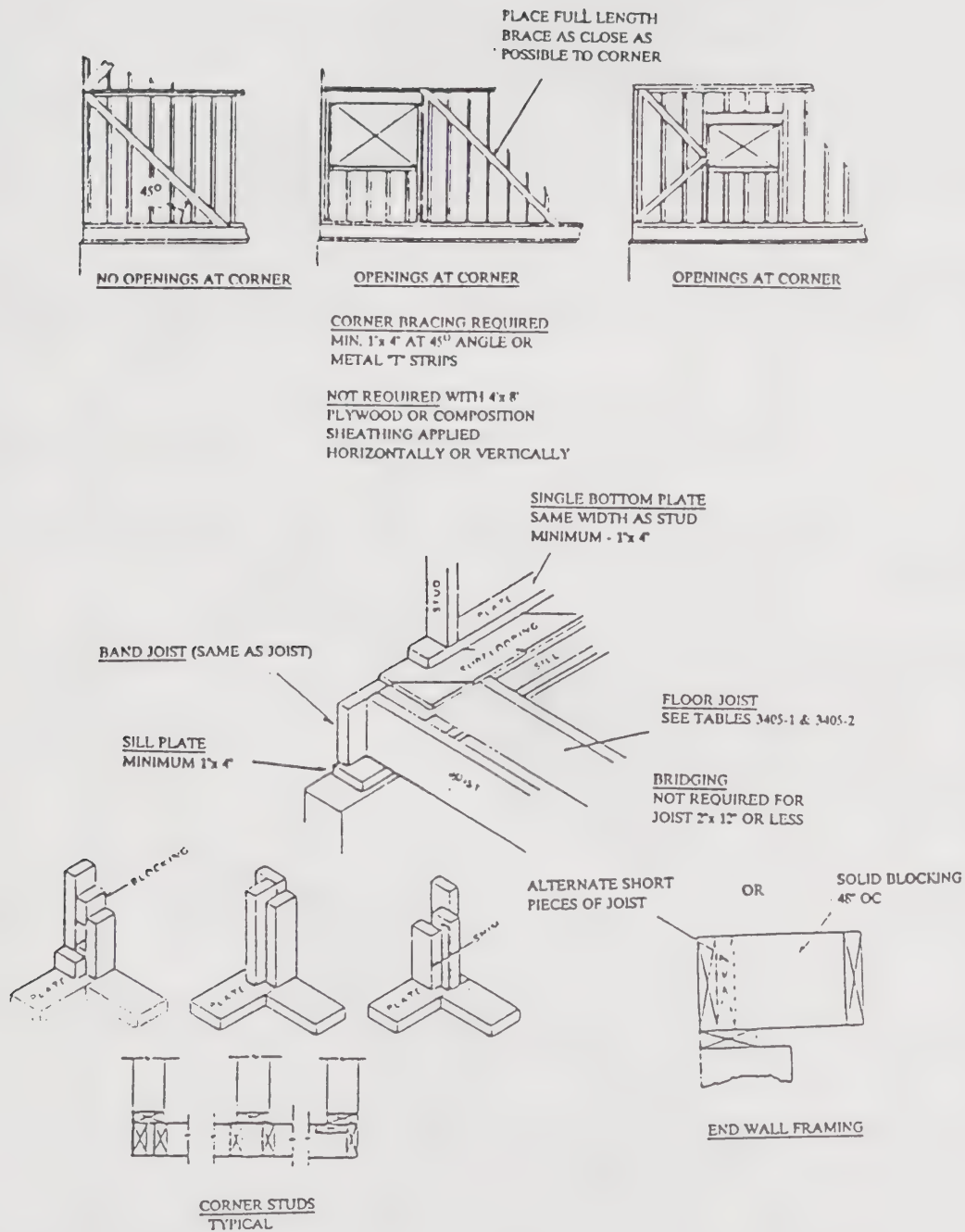


Figure 3403-3
CORNER BRACING REQUIRED



**TABLE 3403-1
NATIVE LUMBER ALLOWABLE STRESS**

	Actual Lumber Size. Closest Size which does not exceed the Dimension Shown	Multiplier Factor Lumber Based on Width	Factor to be added to Col. 3 Factor for Lumber Oversized in Thickness	Factor to be added to Col. 3 Factor for Lumber Oversized in Thickness
Nominal Size	Actual Size Thickness x Width		Thickness Increase of 1/4" to 1/2"	Thickness Increase of over 1/2" to 1"
3 x 8	2-1/2 x 7-1/2 x 7-3/4 x 8	1.0 x F _s 1.07 1.14	+0.10	+0.20
3 x 10	2-1/2 x 9-1/2 x 9-3/4 x 10	1.0 1.05 1.11		
3 x 12	2-1/2 x 11-1/2 x 11-3/4 x 12	1.0 1.04 1.09		
3 x 14	2-1/2 x 13-1/2 x 13-3/4 x 14	1.0 1.04 1.07		
4 x 10	3-1/2 x 9-1/2 x 9-3/4 x 10	1.0 1.05 1.11	+0.07	+0.14
4 x 12	3-1/2 x 11-1/2 x 11-3/4 x 12	1.0 1.04 1.09		
4 x 14	3-1/2 x 13-1/2 x 13-3/4 x 14	1.0 1.04 1.08		

Notes to Table 3403-1 on following page:

Notes to Table 3403-1:

Note 1. Notation: F_s is the allowable maximum fiberstress for the assumed grade as established by this code in Sections 3405.2.2 and 3406.2.1. F_s ("operating" stress) is the modified allowable maximum fiber stress which may be used in the span tables and for calculating required lumber sizes. F_s is found by multiplying F_s by the factors given in the table.

Note 2. Table Columns:

Column 1: is the nominal commonly used lumber size.

Column 2: is a list of actual sizes of the supplied lumber. Column 2 lists the sizes on the basis of a constant thickness and a width increasing by one-quarter (1/4) inch and one-half (1/2) inch.

Column 3: gives the multiplier for increasing the assumed allowable stress (F_s) based on the increase in width as listed in Column 2.

Column 4: gives the multiplier for increasing the assumed allowable stress (F_s) based on increases in thickness.

Note 3. Example: Fiber stress for assumed grade = one thousand (1,000) psi - Actual size 3-1/8 x 9-3/4

Nominal size	1. Multiplier factor for Width	=	1.05
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3 x 10

3-1/8 = increase	2. Multiplier factor for Thickness	=	+.20
------------------	------------------------------------	---	------

of 1/8" total	Sum	1.25
---------------	-----	------

3. Operating stress $F_s = 1.25 \times F_s$
 $F_s = 1.25 \times 1,000 = 1,250$

Therefore, $F_s = 1,250$ psi is used for calculations and in the span tables.

TABLE 3403-2
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

Description of building material	Number & Type ¹ of Fastener ^{2,3,5}	Spacing of fasteners Edges Inter support ⁴
Joist to sill or girder, toe nail	3-8d	-
1"x 6" subfloor to each joist, face nail	2-8d 2 staples, 1-3/4"	- -
Wider than 1"x 6" subfloor to each joist, face nail	3-8d 4 staples, 1-3/4"	- -
2" subfloor to joist or girder, blind & face nail	2-16d	-
Sole plate to joist or blocking, face nail	16d	16" o.c.
Top or sole plate to stud, end nail	2-16d	-
Stud to sole plate, toe nail	4-8d or 3-16d	-
Doubled studs, face nail	16d	24" o.c.
Doubled top plate, face nail	16d	16" o.c.
Top plates, taps & intersections, face nail	2-16d	-
Continued header, two pieces	16d	16" o.c. along each edge
Ceiling joists to plate, toe nail	2-16d	-
Continuous header to stud, toe nail	4-8d	-
Ceiling joist, taps over partitions, face nail	3-16d	-
Ceiling joists to parallel rafters, face nail	3-16d	-
Rafter to plate, toe nail	3-8d	-
1" brace to each stud & plate, face nail	2-8d 2 staples 1-3/4"	-
1"x 6" sheathing to each bearing, face nail	2-8d 2 staples 1-3/4"	
1"x 8" sheathing to each bearing, face nail	2-8d 3 staples 1-3/4"	
Wider than 1"x 8" sheathing to each bearing, face nail	3-8d 4 staples 1-3/4"	
Built-up corner studs	16d	30" o.c.
Built-up girder & beams	20d	32" o.c. at top & bottom & staggered, 2-20d at ends & at each splice
2-inch planks	2-16d	At each bearing
Roof rafters to ridge, valley or hip rafters		
Toe nail	2-16d	-
Face nail	3-16d	-
Collar ties to rafters, face nail	3-8d	-
Plywood subfloor, roof and wall sheathing to frame		
1/2" to 5/16"	6d, staple 16 ga	6" 10" 4" 7"
5/8" to 3/4"	8d smooth or 6d deformed	6" 10"
7/8"	8d	6" 10"
1" to 1-1/8"	10d smooth or 8d deformed	6" 6"
Other wall sheathing ⁶		
1/2" Fiberboard sheathing	1-1/2" galvanized roofing nail, 6d common nail, staple 16 ga 1-1/8" long	3" 6"
25/32" Fiberboard sheathing	1-3/4" galvanized roofing nail, 8d common nail, staple 16 ga 1-1/2" long	3" 6"

Description of building material	Number & Type ¹ of Fastener ^{2,3,5}	Spacing of fasteners Edges Inter support ⁴
1/2" Gypsum sheathing	1-1/2" galvanized roofing nail, 6d common nail, staple 16 ga 1-1/2" long	4" 8"
Particleboard wall sheathing (Exterior type 2-B-1) 3/8" to 1/2"	6d common nail	6" 12"
5/8" to 3/4"	8d common nail staple 16 ga 1-1/2" long	6" 12"
Combination subfloor-underlayment to framing		
3/4" and less	6d deformed	6" 10"
7/8" to 1"	8d deformed	6" 10"
1-1/8" - 1-1/4"	10d smooth or 8d deformed	6" 6"

Notes to Table 3403-2

Note 1. All nails are smooth-common, box or deformed shanks except where otherwise stated.

Note 2. Nail is a general description and may be T-head, modified round head or round head.

Note 3. Staples are sixteen (16) gauge wire and have a minimum seven-sixteenths (7/16) inch O.D. crown width.

Note 4. Nails shall be spaced at not more than six (6) inches o.c. at all supports where spans are forty-eight (48) inches or greater. Nails shall be spaced at not more than ten (10) inches o.c. at intermediate supports for floors.

Note 5. The number of fasteners required for connections not included in this table shall be based on the values set forth in Reference Standard RS-21-6.

Note 6. 4' x 8' or 4' x 9' panels shall be applied vertically.

**TABLE 3403-3
FRAMING SIZES**

Stud Size inches	Wall Bearing	Maximum Spacing (inches)	Min. No. & Plate Size	Min. Sole	Max. Stud Height (feet)	Comments & Notes
2 x 6	yes f	24	single 2x6 a,d	2 x 6	20 b,c,e	2 post corner see Fig 3403.3
2 x 6	no	48	single 2x6 a,d	2 x 6	note 1	"
3 x 4	yes f	24	single 2x4	2 x 4	14 b	
2 x 4	yes f	16	double 2x4 g	2 x 4	14 b,e,h	
2 x 3	no	48	single 2x3	2 x 3	10 e,f,i	Exterior wall & int. partition junction - see Fig 3403.3
2 x 4	no	24	double 2x4 g	2 x 4	14 b,e	"

Notes to Table 3403-3

Note a. Allowed if plate spliced directly over studs.

Note b. Maximum eight (8) foot height for utility studs.

Note c. Allowed in up to three (3) story buildings only.

Note d. Allowed if 1/8" x 1 1/2" x 6" inches metal tie plates used and if ceiling joists and/or roof trusses directly.

Note e. Maximum allowable height unless braced laterally.

Note f. Allowed if supporting not more than a ceiling and roof load when using utility studs.

Note g. If all elements line up, then twenty-four (24) inch spacing allowed with single plate.

Note h. Allowed only up to two (2) stories in height unless first floor is framed with 2" x 6" studs, then three (3) stories.

Note i. Ten (10) foot maximum for utility studs.

Note j. One (1) inch sole plate attached to studs by end nailing is acceptable.

Note k. Exceptions are allowed when an engineering analysis using standard accepted practice is provided to justify variations from the above Table 3403-3.

TABLE 3403-4
MAXIMUM ALLOWABLE SPANS FOR HEADER
SUPPORTING WOOD FRAME WALLS

Size of Steel Header	Size of Wood Header ³	Allowable Span of Headers in Ft for Bearing Walls ^{1,2}			
		Sptg. Roof	One Story Above	Two Stories Above	All. Span of Headers in Garages or in Walls not supporting Floors or Roofs
2-1/2x2-1/2x1/4	2-2"x4"	4'	-	-	6'
3-1/2x3-1/2x1/4	2-2"x6"	4' to 6'	4'	-	6' to 8'
6x1-7/8 jr	2-2"x8"	6' to 8'	4' to 6'	-	8' to 10'
4x2-5/8	2-2"x10"	8' to 10'	6' to 8'	4' to 6'	10' to 12'
7x2-1/8 jr	2-2"x12"	10' to 12'	8' to 10'	6' to 8'	12' to 16'

Notes to Table 3403-4

Note 1. Based on header providing support for wall height equal to width of opening.

Note 2. Nominal four (4) inch wide single headers maybe substituted for the double members.

Note 3. Spans are based on number two (2) or Standard Grade lumber. Number three (3) Grade lumber may be used with appropriate design.

TABLE 3403-5
PLYWOOD WALL SHEATHING
 Face Grain Parallel or Perpendicular to Studs

Minimum thickness	Panel identification index	Stud Spacing (inches)		
		Siding nailed to studs	Sheathing parallel to studs	Siding nailed to sheathing, sheathing perpendicular to studs
5/16	12/0,16/0,20/0	16	-	16
3/8	16/0,20/0,24/0	24	16	24
1/2	24/0,32/16	24	24	24

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**TABLE 3403-6
ALLOWABLE SPAN FOR MASONRY WALLS
BETWEEN LATERAL SUPPORTS**

Type of Masonry Wall	Allowable ⁴ H or L (between supports) ¹
Stone	14 x t (see Note 2)
Cavity and ³ Hollow Units	18 x t (see Note 2)
Solid and Grouted (plain)	20 x t (see Note 2)
Reinforced Grouted	25 x t (see Note 2)

Notes to Table 3403-6

Note 1. Support may be provided by roofs, floors, foundations, beams, etc., in vertical direction or by pilasters, columns, piers, cross walls, etc., in horizontal direction, either but not both are required.

Note 2. "t" is taken as the nominal thickness of the wall in inches.

Note 3. "t" for cavity walls, is the sum of the nominal thickness of the wythes without the cavity.

Note 4. An additional unsupported height of six (6) feet is permitted for gable end walls.

**TABLE 3403-7
ALLOWABLE SPAN FOR MASONRY AND STEEL
LINTELS SUPPORTING MASONRY WALLS**

Number of 1/2" diameter or equivalent area reinforcing bars ¹	Allowable Span in Feet and Inches ²			Structural Steel ³
	No floor above	One floor above	Two floors above	
1	4' - 6"	3' - 0"	2' - 6"	L 2-1/2 x 2-1/2x5/16 L 3x3x1/4
2	6' - 0"	4' - 0"	3' - 6"	L 3-1/2x3-1/2x5/16 ST 5I
3	8' - 6"	5' - 0"	4' - 0"	ST 5 ST 6I
4	10' - 0"	6' - 0"	5' - 0"	ST 6 ST 8B

Note 1. Depth of reinforced lintels shall be not less than eight (8) inches and all cells of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than eight (8) inches into the support.

Note 2. Based on ten (10) foot tributary floor and roof loads; in other words, headers located in exterior walls and supporting twenty (20) foot span joists or headers located in interior bearing walls and supporting joists spanning ten (10) foot wide rooms on each side.

Note 3. Extend steel lintels six (6) inches into the support.

**TABLE 3403-7A
ALLOWABLE SPANS FOR LINTELS
SUPPORTING MASONRY VENEER**

Size of steel angle ¹	No story above	One story above	Two stories above	No. of 1/2" or equivalent reinforcing bars ²
L 3x3x1/4	6' - 0"	3' - 6"	3' - 0"	1
L 4x3x1/4	8' - 0"	5' - 0"	3' - 0"	1
L 6x3-1/2x1/4	14' - 0"	8' - 0"	3' - 6"	2
L 2-6x3-1/2x1/4	20' - 0"	11' - 0"	5' - 0"	4

Notes to Table 3403-7A

Note 1. Long leg of the angle shall be placed in a vertical position.

Note 2. Depth of reinforced lintels shall be not less than eight (8) inches and all cells of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than eight (8) inches into the support.

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TABLE 3403-8A
DESIGN VALUES FOR JOISTS AND RAFTERS - VISUAL GRADING

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"
		Normal Duration	Snow Loading	7 Day Loading	
ASPEN (surfaced Dry or surfaced green)					
Select structural	2 x 5 and wider	1300	1500	1620	1,100,000
No. 1 & appear.		1100	1260	1380	1,100,000
No. 2		900	1040	1120	1,100,000
No. 3		525	600	660	900,000
Stud		525	600	660	900,000
BALSAM FIR (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1350	1550	1690	1,200,000
No. 1 & appear.		1150	1320	1440	1,200,000
No. 2		950	1090	1190	1,100,000
No. 3		550	630	690	900,000
Stud		550	630	690	900,000
BLACK COTTONWOOD (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1000	1150	1250	1,200,000
No. 1 & appear.		875	1010	1090	1,200,000
No. 2		700	800	880	1,100,000
No. 3		425	490	530	900,000
Stud		425	490	530	900,000
CALIFORNIA REDWOOD (surfaced dry or surfaced green)					
Select Structural	2 x 5 and wider	2000	2300	2500	1,400,000
Select Structural, Open grain		1600	1840	2000	1,100,000
No. 1		1700	1960	2120	1,400,000
No. 1, Open grain		1350	1550	1690	1,100,000
No. 2		1400	1610	1750	1,250,000
No. 2, Open grain		1100	1260	1380	1,000,000
No. 3		800	920	1000	1,100,000
No. 3, Open grain		650	750	810	900,000
Stud		650	750	810	900,000
SITKA SPRUCE (surfaced dry or surfaced green)					
Select structural	2 x 5	1500	1720	1880	1,700,000
No. 1 & appear.	and	1250	1440	1560	1,700,000
No. 2	wider	1050	1210	1310	1,500,000
No. 3		600	690	750	1,300,000
Stud		600	690	750	1,300,000
COAST SPECIES (surfaced dry or surfaced green)					
Select structural	2 x 5	1500	1720	1880	1,500,000
No. 1 & appear.	and	1250	1440	1560	1,500,000
No. 2	wider	1050	1210	1310	1,400,000
No. 3		600	690	750	1,200,000
Stud		600	690	750	1,200,000
DOUGLAS FIR - LARCH (surfaced dry or surfaced green)					
Dense Select Structural	2 x 5 and wider	2400	2760	3000	1,900,000
Select Structural		2050	2360	2560	1,800,000
Dense No. 1		2050	2360	2560	1,900,000
No. 1 & Appearance		1750	2010	2190	1,800,000
Dense No. 2		1700	1960	2120	1,700,000
No. 2		1450	1670	1810	1,700,000
No. 3		850	980	1060	1,500,000
Stud		850	980	1060	1,500,000
DOUGLAS FIR - SOUTH (surfaced dry or surfaced green)					
Select structural	2 x 5	1950	2240	2440	1,400,000
No. 1 & appear.	and	1650	1900	2060	1,400,000
No. 2	wider	1350	1550	1690	1,300,000
No. 3		800	920	1000	1,100,000
Stud		800	920	1000	1,100,000

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing the "F_b" values should be reduced 13%. Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

ONE AND TWO-FAMILY DWELLING

TABLE 3403-8B
DESIGN VALUES FOR JOISTS AND RAFTERS - VISUAL GRADING

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"
		Normal Duration	Snow Loading	7 Day Loading	
EASTERN HEMLOCK-TAMARAK (surfaced Dry or surfaced green)					
Select structural	2 x 5 and wider	1750	2010	2190	1,300,000
No. 1 & appear.		1500	1720	1880	1,300,000
No. 2		1200	1380	1500	1,100,000
No. 3		725	830	910	1,000,000
Stud		725	830	910	1,000,000
EASTERN SPRUCE (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1500	1720	1880	1,400,000
No. 1 & appear.		1250	1440	1560	1,400,000
No. 2		1000	1150	1250	1,200,000
No. 3		600	690	750	1,100,000
Stud		600	690	750	1,100,000
EASTERN WHITE PINE (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1350	1550	1690	1,200,000
No. 1 & appear.		1150	1320	1440	1,200,000
No. 2		950	1090	1190	1,100,000
No. 3		550	630	690	1,000,000
Stud		550	630	690	1,000,000
EASTERN WOODS (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1300	1500	1620	1,100,000
No. 1 & appear.		1100	1260	1380	1,100,000
No. 2		900	1040	1120	1,000,000
No. 3		525	600	660	900,000
Stud		525	600	660	900,000
ENGELMANN SPRUCE-ALPINE FIR (Engelmann Spruce -Lodgepole Pine)					
Select structural	2 x 5 and wider	1350	1550	1690	1,300,000
No. 1 & appear.		1150	1320	1440	1,300,000
No. 2		950	1090	1190	1,100,000
No. 3		550	630	690	1,000,000
Stud		550	630	690	1,000,000
HEM - FIR (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1650	1900	2060	1,500,000
No. 1 & appear.		1400	1610	1750	1,500,000
No. 2		1150	1320	1440	1,400,000
No. 3		675	780	840	1,200,000
Stud		675	780	840	1,200,000
IDAHO WHITE PINE (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1300	1500	1620	1,400,000
No. 1 & appear.		1100	1260	1380	1,400,000
No. 2		925	1060	1160	1,300,000
No. 3		550	630	690	1,200,000
Stud		550	630	690	1,200,000
LODGEPOLE PINE (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1500	1720	1880	1,300,000
No. 1 & appear.		1300	1500	1620	1,300,000
No. 2		1050	1210	1310	1,200,000
No. 3		625	720	780	1,000,000
Stud		625	720	780	1,000,000

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values should be reduced 13%. Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

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TABLE 3403-8C
DESIGN VALUES FOR JOISTS AND RAFTERS - VISUAL GRADING

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values should be reduced 13%.

Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"
		Normal Duration	Snow Loading	7 Day Loading	
MOUNTAIN HEMLOCK (surfaced Dry or surfaced green)					
Select structural		1700	1960	2120	1,300,000
No. 1 & appear.	2 x 5	1450	1670	1810	1,300,000
No. 2	and	1200	1380	1500	1,100,000
No. 3	wider	700	800	880	1,000,000
Stud		700	800	880	1,000,000
MOUNTAIN HEMLOCK - HEM - FIR (surfaced dry or surfaced green)					
Select structural		1650	1900	2060	1,300,000
No. 1 & appear.	2 x 5	1400	1610	1750	1,300,000
No. 2	and	1150	1320	1440	1,100,000
No. 3	wider	675	780	840	1,000,000
Stud		675	780	840	1,000,000
NORTHERN PINE (surfaced dry or surfaced green)					
Select structural		1600	1840	2000	1,400,000
No. 1 & appear.	2 x 5	1400	1610	1750	1,400,000
No. 2	and	1100	1260	1380	1,300,000
No. 3	wider	650	750	810	1,100,000
Stud		650	750	810	1,100,000
NORTHERN SPECIES (surfaced dry or surfaced green)					
Select structural		1300	1500	1620	1,100,000
No. 1 & appear.	2 x 5	1150	1320	1440	1,100,000
No. 2	and	925	1060	1160	1,100,000
No. 3	wider	550	630	690	900,000
Stud		550	630	690	900,000
NORTHERN WHITE CEDAR (surfaced dry or surfaced green)					
Select structural	2 x 5	1150	1320	1440	800,000
No. 1 & appear.	and	1000	1150	1250	800,000
No. 2	wider	825	950	1030	700,000
No. 3		475	550	590	600,000
Stud		475	550	590	600,000
PONDEROSA PINE (surfaced dry or surfaced green)					
Select structural	2 x 5	1400	1610	1750	1,200,000
No. 1 & appear.	and	1200	1380	1500	1,200,000
No. 2	wider	975	1120	1220	1,100,000
No. 3		575	660	720	1,000,000
Stud		575	660	720	1,000,000
PONDEROSA PINE - SUGAR PINE (PONDEROSA PINE - LODGEPOLE PINE) (surfaced dry or surfaced green)					
Select structural	2 x 5	1400	1610	1750	1,200,000
No. 1 & appear.	and	1200	1380	1500	1,200,000
No. 2	wider	975	1120	1220	1,100,000
No. 3		575	660	720	1,000,000
Stud		575	660	720	1,000,000
RED PINE (surfaced dry or surfaced green)					
Select structural	2 x 5	1350	1550	1690	1,300,000
No. 1 & appear.	and	1150	1320	1440	1,300,000
No. 2	wider	950	1090	1190	1,200,000
No. 3		550	630	690	1,000,000
Stud		550	630	690	1,000,000

TABLE 3403-8D
DESIGN VALUES FOR JOISTS AND RAFTERS - VISUAL GRADING

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values should be reduced 13%.

Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F _b "			Modulus of Elasticity "E"
		Normal Duration	Snow Loading	7 Day Loading	
SITKA SPRUCE (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1550	1780	1940	1,500,000
No. 1 & appear.		1300	1500	1620	1,500,000
No. 2		1050	1210	1310	1,300,000
No. 3		600	690	750	1,200,000
Stud		600	690	750	1,200,000
SOUTHERN PINE (surfaced dry)					
Select structural	2 x 5 and wider	2000	2300	2500	1,700,000
Dense select struct.		2350	2700	2940	1,800,000
No. 1		1700	1960	2120	1,700,000
No. 1 dense		2000	2300	2500	1,800,000
No. 2		1400	1610	1750	1,600,000
No. 2 dense		1650	1900	2060	1,600,000
No. 3		800	920	1000	1,400,000
No. 3 dense		925	1060	1160	1,500,000
Stud		850	980	1060	1,400,000
SOUTHERN PINE (surfaced at 15% moisture content KD)					
Select structural	2 x 5 and wider	2150	2470	2690	1,800,000
Dense select struct.		2500	2880	3120	1,900,000
No. 1		1850	2130	2310	1,800,000
No. 1 dense		2150	2470	2690	1,900,000
No. 2		1500	1720	1880	1,600,000
No. 2 dense		1750	2010	2190	1,700,000
No. 3		875	1010	1090	1,500,000
No. 3 dense		1000	1150	1250	1,500,000
Stud		900	1040	1120	1,500,000
SPRUCE-PINE-FIR (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1450	1670	1810	1,500,000
No. 1 & appear.		1200	1380	1500	1,500,000
No. 2		1000	1150	1250	1,300,000
No. 3		575	660	720	1,200,000
Stud		575	660	720	1,200,000
WESTERN CEDARS (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1500	1720	1880	1,100,000
No. 1 & appear.		1300	1500	1620	1,100,000
No. 2		1050	1210	1310	1,000,000
No. 3		625	720	780	900,000
Stud		625	720	780	900,000
WESTERN CEDARS (NORTH) (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1450	1670	1810	1,100,000
No. 1 & appear.		1250	1440	1560	1,100,000
No. 2		1000	1150	1250	1,000,000
No. 3		600	690	750	900,000
Stud		600	690	750	900,000
EASTERN HEMLOCK (surfaced dry or surfaced green)					
Select structural	2 x 5 and wider	1750	2010	2190	1,200,000
No. 1 & appear.		1500	1720	1880	1,200,000
No. 2		1250	1440	1560	1,100,000
No. 3		725	830	910	1,000,000
Stud		725	830	910	1,000,000

TABLE 3403-9
DESIGN VALUES FOR JOISTS AND RAFTERS -
MACHINE STRESS RATED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values should be reduced 13 percent.

Values apply at 19 percent maximum moisture content in use.

Grade Designation	Grading rules agency (see notes 1,2,3,4)	Size Classification	Design value in bending "F _b "			Modulus of Elasticity "E"
			Normal Duration	Snow Loading	7-Day Loading	
900f-1.0E	3	Machine Rated Lumber, 2 x 4 and wider	1050	1210	1310	1,000,000
1200f-1.2E	1,2,3,4		1400	1610	1750	1,200,000
1350f-1.3E	2,4		1550	1780	1940	1,300,000
1450f-1.3E	1,3,4		1650	1900	2060	1,300,000
1500f-1.4E	1,2,3,4		1750	2010	2190	1,400,000
1650f-1.5E	1,2,3,4		1900	2180	2380	1,500,000
1800f-1.6E	1,2,3,4		2050	2360	2560	1,600,000
1950f-1.7E	1,2,4		2250	2590	2810	1,700,000
2100f-1.8E	1,2,3,4		2400	2760	3000	1,800,000
2250f-1.9E	1,2,4		2600	2990	3250	1,900,000
2400f-2.0E	1,2,3,4		2750	3160	3440	2,000,000
2550f-2.1f	1,2,4		2950	3390	3690	2,100,000
2700f-2.2E	1,2,3,4		3100	3570	3880	2,200,000
2850f-2.3E	2,4		3300	3800	4130	2,300,000
3000f-2.4E	1,2,4		3450	3970	4310	2,400,000
3150f-2.5E	2,4		3600	4140	4500	2,500,000
3300f-2.6E	2,4		3800	4370	4750	2,600,000
900f-1.0E	1,2,3,4	See Notes	1050	1210	1310	1,000,000
900f-1.2E	1,2,3,4		1050	1210	1310	1,200,000
1200f-1.5E	1,2,3,4		1400	1610	1750	1,500,000
1350f-1.8E	1,2,4		1550	1780	1940	1,800,000
1500f-1.8E	3		1750	2010	2190	1,800,000
1800f-1.8E	1,2,3,4		2050	2360	2560	2,100,000

Note 1. National Lumber Grades Authority (see Note 2, Table W-1); Machine Rated Lumber, 2 x 4 & wider.

Note 2. Southern Pine Inspection Bureau; Machine Rated Lumber, 2 x 4 & wider.

Note 3. West Coast Lumber Inspection Bureau; Machine Rated Lumber, 2 x 4 & wider; Machine Rated Joists, 2 x 6 & wider.

Note 4. Western Wood Products Association; Machine Rated Lumber, 2 x 4 & wider.

SECTION 3404.0 WALL COVERING

3404.1 General: Interior and exterior wall covering shall conform to the requirements of this section.

3404.1.1 Compliance: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

3404.2 Interior coverings

3404.2.1 General: Interior coverings shall be installed in accordance with this section and Table 3404-6.

3404.2.2 Vertical assemblies: Vertical support for lath or gypsum wallboard shall be not less than two (2) inches nominal in least dimension. Wood stripping for furring shall be not less than two (2) inches nominal thickness in the least dimension except that furring strips not less than one (1) inch by two (2) inch dimension may be used over solid backing.

3404.2.3 Moisture protection: Where wood frame walls and partitions are covered on the interior with plaster or tile or similar material and subject to water splash, the framing shall be protected with an approved moisture barrier.

3404.2.3.1 Lath application: Gypsum lath shall be applied with the long dimension perpendicular to supports, and with end joints staggered in successive courses. End joints may occur on one support where lath is applied the full length of the joint.

3404.2.3.2 Attachment: The type and weight of metal lath, the gauge and spacing of nails and staples, the spacing of supports, and the methods of attachment to wood supports shall be as set forth in the reference standards, except that gypsum veneer plaster may be applied in one (1) coat.

3404.2.4 Interior plaster: Plastering with gypsum plaster or portland cement plaster shall be not less than three (3) coats when applied over metal lath or wire lath and shall be not less than two (2) coats when applied over other bases permitted by this section except that veneer plaster may be applied in one (1) coat, not to exceed three-sixteenths (3/16) inch thickness.

3404.2.5 Gypsum wallboard: All gypsum wallboard shall be installed in accordance with the provisions of this section.

3404.2.5.1 Installation protection: Gypsum wallboard shall not be installed until weather protection is provided.

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3404.2.5.2 Supports: Supports shall be spaced not to exceed the spacing as set forth in Table 3404-6 for single-ply application.

3404.2.5.3 Spacing: All edges and ends of gypsum wallboard shall occur on the framing members, except those edges and ends which are perpendicular to the framing members.

3404.2.5.4 Fastening: The size and spacing of fasteners shall comply with Table 3404-6.

3404.2.6 Shower and bath compartments: Shower and bath stalls and compartments shall be finished in accordance with the requirements of 105 CMR 410.000 (Article II State Sanitary Code, Minimum Standards of Fitness for Human Habitation).

3404.2.7 Other interior finishes: All approved interior finishes shall conform to the applicable reference standards of this article.

3404.3 Exterior coverings

3404.3.1 General: Exterior coverings shall be installed in accordance with this section, Table 3404-7 and manufacturer's recommendations.

3404.3.2 Exterior lath: All lath and lath attachments shall be of corrosion-resistant materials.

3404.3.2.1 Backing: Backing for vertical surfaces shall consist of sheathing or of not less than No. 18 U.S. gauge steel wire stretched taut horizontally and spaced not more than six (6) inches apart vertically.

3404.3.2.2 Backing support: Where lath on vertical surfaces extends between rafters, or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.

3404.3.2.3 Gypsum lath: Gypsum lath shall not be used, except that on horizontal supports of ceilings or roof soffits, it may be used as backing for metal lath or wire lath and portland cement plaster.

3404.3.2.4 Required backing: Backing is not required under metal lath or paperbacked wire lath.

3404.3.3 Exterior plaster: Plastering with portland cement plaster shall be not less than three (3) coats when applied over metal lath or wire lath and shall be not less than two (2) coats when applied over masonry, concrete, or gypsum backing. If

plaster surface is completely covered by veneer or other facing material, or is completely concealed, plaster application need only be two (2) coats provided the total thickness is as set forth by manufacturer's recommendations.

3404.3.4 Masonry veneer

3404.3.4.1 General: All masonry veneer shall be installed in accordance with this section and manufacturer's recommendations.

3404.3.4.2 Veneer support: Masonry veneer shall not support any vertical load other than the dead load of the veneer above. Veneer above openings shall be supported upon lintels of non-combustible material and the allowable span shall not exceed the values set forth in Table 3403-7. The lintels shall have a bearing of not less than four (4) inches.

3404.3.4.3 Metal ties: Masonry veneer shall be attached to the supporting wall with corrosion-resistant metal ties. Veneer ties, if strand wire, shall be not less in thickness than No. 6 U.S. gauge wire and shall have a hook embedded in the mortar joint, or if sheet metal, not less than No. 22 U.S. gauge corrugated. Each tie shall be spaced not more than twenty-four (24) inches on center horizontally and shall support not more than three and one-quarter (3-1/4) square feet of wall area.

Exception: In wind areas of more than thirty (30) pounds per square foot, each tie shall support not more than two (2) square feet of wall area.

3404.3.4.4 Other method: In lieu of such wire ties, an approved method of grouting the veneer to a paperbacked reinforcement attached directly to the studs may be used.

3404.3.5 Weather protection

3404.3.5.1 Wall protection: Exterior walls shall be covered with a weather-resistant siding and/or membrane.

3404.3.5.2 Weather-resistant membrane: Asphalt-saturated felt free from holes and breaks and weighing not less than fourteen (14) pounds per one hundred (100) square feet or other approved weather-resistant membrane shall be applied over studs or sheathing of all exterior walls as required by Table 3404-7. Such felt or membrane shall be applied weatherboard fashion, lapped not less than two (2) inches at horizontal joints and not less than six (6) inches at vertical joints.

Exception: Such felt or membrane may be omitted in the following cases:

1. Under weather-resistant siding as per Table 3404-7.
2. In accessory buildings.
3. Under approved paperbacked metal or wire fabric lath.

4. Under metal lath, wire lath or wire fabric lath on non-combustible construction.
5. Under insulated sheathing boards.

3404.3.5.3 Flashing: Approved corrosion-resistive flashing shall be provided at top and sides of all exterior window and door openings in such manner as to be leakproof. Similar flashings shall be installed at the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings; under and at the ends of masonry, wood or metal copings and sills; continuously above all projecting wood trim; at wall and roof intersections; under built-in gutters; at junction of chimneys and roofs; in all roof valleys and around all roof openings.

3404.3.6 Sheathing

3404.3.6.1 Plywood application: Exterior plywood joints shall occur over framing members, unless wood or plywood sheathing is used underneath, or joints are lapped horizontally a minimum of one and one-half (1-1/2) inches, or battens are applied, or tongue and groove or ship lap sheets are used, or otherwise made waterproof to the satisfaction of the building official.

3404.3.6.2 Sheathing Insulation board: Insulation boards are approved for sheathing when recognized for this use by a Reference Standard agency listed in Appendix A of the basic code.

1. Each board shall be clearly marked with a model code approval, recognized testing laboratory label, or as approved by the BBRS.

2. Insulation-sheathing boards are to be fastened at each stud. When square edged boards are used, vertical joints must be over framing members. When tongue and groove edged boards are used, vertical joints may fall between studs when the boards above and below the joint are continuous across that wall area. Fasteners may be seven-sixteenths (7/16) inch head roofing nails or three-quarters (3/4) inch crown staples on eight (8) inch centers, one (1) inch head nails or one (1) inch crown staples on twelve (12) inch centers, or any other fastener approved by the building official.

All fasteners shall be long enough to penetrate the studs a minimum of one-half (1/2) inch.

Exterior finish-siding fasteners must go through the sheathing and into the studs a minimum of three-quarters (3/4) inch.

3. A membrane under the siding is not required when insulation-sheathing boards are used.

TABLE 3404-6
APPLICATION OF GYPSUM WALLBOARD

Thickness of gypsum wallboard (inches)	Plane of framing surface	Long dimension of gypsum wallboard sheets in relation to direction of framing members	Maximum spacing of framing members (center-to-center) (inches)	Maximum spacing of fasteners (center-to-center) (inches)		Nails ¹ to Wood
				Nail ^{1,2}	Screw ³	
1/2	Horizontal	Either direction	16		12	No. 13 ga,1-3/8" long, 19/64" head No. .098 ga,1-1/4" long. Annular ringed 5d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical		24	8	12	
5/8	Horizontal	Either direction	16	7	12	No. 13 ga,1-5/8" long, 19/64" head No. .098 ga,1-3/8" long. Annular ringed 6d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either direction	24		12	
Fastening Required with Adhesive Application						
1/2 or 5/8	Horizontal	Either direction	16	16	16	As required for 1/2" and 5/8" gypsum wallboard, see above
		Perpendicular	24	12	16	
	Vertical	Either direction	24	24	24	
2-3/8 (3/4 total)	Horizontal	Perpendicular	24	16	16	Base ply nailed as required for 1/2" gypsum wallboard, and face ply placed with adhesive
	Vertical	Either direction	24	24	24	

Note 1. Where the metal framing has a clinching design formed to receive the nails by two (2) edges of metal, the nails shall be not less than five-eighths (5/8) inch longer than the wallboard thickness, and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, No. 13 1/2 gauge, one and five-eighths (1 5/8) inches long, fifteen-sixty-fourths (15/64) inch head for one-half (1/2) inch gypsum wallboard; 6d, No. 13 gauge, one and seven-eighths (1 7/8) inches long, fifteen-sixty-fourths (15/64) inch head for five-eighths (5/8) inch gypsum wallboard.

Note 2. Two (2) nails spaced not less than two (2) inches apart, nor more than two and one-half (2 1/2) inches apart and pairs of nails spaced not more than twelve (12) inches center-to-center may be used.

Note 3. Screws shall be No. 6 with tapered head and long enough to penetrate into wood framing not less than five-eighths (5/8) inch and metal framing not less than one-quarter (1/4) inch.

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TABLE 3404-7
WEATHER-RESISTANT SIDING ATTACHMENT

Siding Material		Nominal Thickness (inches)	Joint Treatment	Weather resistant membrane required	Type of supports for the siding material & fasteners				
					Wood or plywood sheathing	Fiberboard sheathing into stud	Gypsum sheathing into stud	Direct to studs	No & Spacing of fasteners
Horiz. Alum. ⁶	Without insulation	.019 ¹⁰	lap	no	.120-nail 1½" long	.120-nail 2" long	.120-nail 2" long	Not allowed	Same as stud spacing
		.024	lap	no	.120-nail 1½"	.120-nail 2"	.120-nail 2"	Not allowed	
	With insulation	.019	lap	no	.120-nail 1½"	.120-nail 2½"	.120-nail 2½"	.120-nail 1½"	
Horizontal asbestos cement boards shingles ⁷		5/32 ¼	(2) lap	(2) yes	.113 nail 1½"	.113 nail 2"	.113 nail 1½"	.113 nail 1½"	2 nails per shingle
Brick veneer Clay tile veneer Concrete veneer		2 ¼ to 1 ¼	s. 3403.3	yes	See Section 3403.3 & Figure 3403-1				
Horizontal fiberboard ³		½	s. 3403.3	no	.099 nail 2" staple 1½"	.113 nail 2½" staple 2½"	.113 nail 2½" staple 2½"	.099 nail 2" staple 1½"	same as stud spacing
Hardboard ³ board & batten vertical		¼	(2)	(2)	.099 nail 2" staple 1½"	.099 nail 2½" staple 2"	.099 nail 2" staple 1½"	.099 nail 1½" staple 1½"	6" panel edges 12" inter. sup
Hardboard ³ lap siding horizontal		7/16	(2)	(2)	.099 nail 2" staple 1½"	.099 nail 2½" staple 2½"	.099 nail 2½" staple 2½"	.099 nail 2" staple 1½"	same as stud spacing 2 per bearing
Vertical panel siding		7/16	(2)	(2)	.099 nail 2" staple 1½"	.099 nail 2 1/2" staple 2½"	.099 nail 2" staple 2"	.080 nail 1 3/4" staple 1½"	6" panel edges 12" inter. sup
Steel ³		29 ga.	lap	no	.113 nail 1½" staple 1½"	.113 nail 2 3/4" staple 2½"	.113 nail 2½" staple 2½"	not allowed	same as stud spacing
Stone veneer		2	s. 3403.3	yes	See section 3403.2 & Figure 3403-3				
Particleboard panels		¾	(2)	(2)	.113 NG 1-2" staple 1½"	.113 nail 2½" staple 2½"	.113 nail 1-2" staple 2"	not allowed	same as stud spacing
		¾	(2)	(2)	.113 nail 2" staple 1½"	.113 nail 2½" staple 2½"	.113 nail 2½" staple 2½"	.113 nail 2" staple 1½"	
Plywood panels ¹¹ (exterior grade)		¾	(2)	(2)	.099 nail 2" staple 1½"	.113 nail 2½" staple 2½"	.099 nail 2" staple 2"	.099 nail 2" staple 1½"	6" on edges 12" inter. sup
Wood Rustic, drop Shiplap Bevel Butt Tipp		¾ 19/32av	lap	no	Fastener penetration into stud-1"			.113 nail 2½" staple 2"	Nails/ bearing up to 6" width 1 nail 8" width & over, 2 nails
		7/16	lap	no					
		3/16	lap	no					
Shakes ⁷		¾	lap	yes	.0915 Nail-2" Staple 2"				
Shingles ⁷		¾	lap	yes	16" & 18" shingles	.076-nail-1-½"		2 fasteners per shingle or shake	
						Staple - 1-½"			
					24" shingles	.080-nail- 1-½"			
						Staple - 1-½"			

Notes to Table 3404-7

Note 1. Based on stud spacing of sixteen (16) inches o.c. Where studs are spaced twenty-four (24) inches, siding may be applied to sheathing approved for that spacing.

Note 2. If boards are applied over sheathing or weather-resistant membrane joints need not be treated. Otherwise, vertical joints must occur at studs and covered with batts.

Note 3. Shall be of approved type.

Note 4. Nail is a general description and may be T-head, modified round head, or round head with smooth or deformed shanks.

Note 5. Staples shall have a minimum crown width of seven-sixteenths (7/16) inch o.d. and be manufactured of minimum sixteen (16) gauge wire.

Note 6. All attachments shall be coated with a corrosion-resistive coating.

Note 7. Shingles and shakes applied over regular density fiberboard or gypsum sheathing shall be fastened to horizontal wood nailers or fiberboard shingle backer.

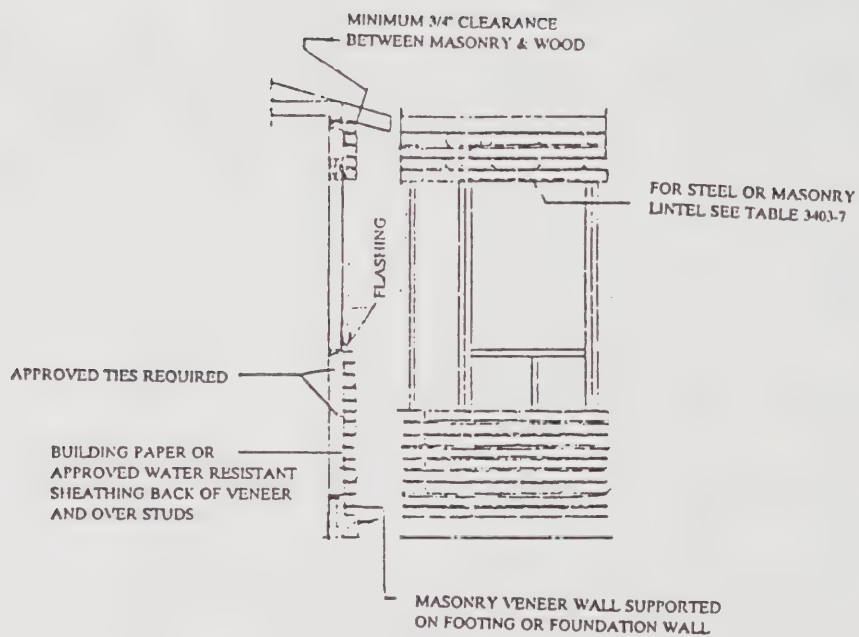
Note 8. Aluminum nails shall be used to attach aluminum siding.

Note 9. Nails or staples must be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs for fiberboard or gypsum backing.

Note 10. Aluminum (0.19-inch) may be unbacked only when the flat areas are five (5) inches or less in the narrow dimension.

Note 11. Three-eighths (3/8) inch plywood may be applied direct to studs spaced sixteen (16) inches on center. One-half (1/2) inch plywood may be applied direct to studs spaced twenty-four (24) inches on center.

FIGURE 3404-7
MASONRY VENEERED WALL



SECTION 3405.0 FLOORS

3405.1 General: Design of floors shall be based on a first floor live load of forty (40) pounds per square foot and a second floor live load of thirty (30) pounds per square foot, with twenty (20) pounds per square foot for nonusable attics. Floors shall be constructed in accordance with the requirements of this article and Figures 3403-1 and 3403-2, Tables 3405-1 through 3405-6, and nailed in accordance with Table 3403-2, or shall comply with the reference standards of this article.

3405.1.1 Compliance: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be accepted as providing compliance with the requirements of this article.

3405.2 Wood

3405.2.1 Identification: All load-bearing lumber, plywood and particle-board shall conform to applicable standards or grading rules and shall be so identified by a grade mark, or certificate of inspection issued by an approved lumber grading or inspection bureau or agency.

3405.2.2 Grade: All joists and beams shall be of at least No. 3 or Standard Grade lumber or equivalent. Blocking and sheathing may be of Utility or No. 4 Grade lumber or equivalent.

Exception: Native lumber - Items 3405.2.1 Identification and 3405.2.2 Grade of this section shall be subject to the provisions of Section 3403.3 for native lumber.

3405.2.3 Allowable spans: The unsupported spans or floor joists shall not exceed the values set forth in Tables 3405-1 and 3405-2. The modulus of elasticity, "E", and the actual stress in bending, "Fb", shown in the Tables shall not exceed the values given.

3405.2.3.1 Girder spans: The allowable spans of girders shall be designed in accordance with Table 3405-6 and accepted engineering practice.

3405.2.3.2 Floor sheathing span: The allowable spans and minimum grades for plywood floor sheathing shall conform to the requirements set forth in Tables 3405-3 and 3405-4. The allowable spans for floor sheathing shall conform to the requirements set forth in Table 3405-5.

3405.2.4 Bearing: The ends of each joist shall have not less than one and one-half (1-1/2) inches of bearing on wood or metal and not less than three (3) inches on

masonry except where supported on a one (1) inch by four (4) inch ribbon strip and nailed to the adjacent stud.

3405.2.5 Lateral support: Joists shall be supported laterally at the ends.

3405.3 Concrete floors (on ground)

3405.3.1 General: Concrete slab-on-ground floors shall be constructed according to accepted engineering practice. The concrete shall conform to the requirements of Section 3402.2 and only approved air-entraining agents shall be used where required. When part of heated space, perimeter insulation is required according to Section 3420.5.

3405.3.1.1 Contraction joints: Slabs shall be constructed with contraction joints, having a depth of at least one-fourth (1/4) the slab thickness, and joints shall be spaced at intervals not more than thirty (30) feet in each direction and slabs not rectangular in shape shall have contraction joints across the slab at points of offset, if offset exceeds ten (10) feet.

Exception: Contraction joints are not required where 6 x 6--6/6 welded wire fabric or equivalent is placed at mid-depth of the slab.

3405.3.2 Site preparation: The area within the foundation walls shall have all vegetation, top soil and foreign material removed and the fill material shall be free of vegetation and foreign material.

3405.3.2.1 Soil compaction: The fill shall be compacted to assure uniform support of the slab and except where otherwise approved the fill depths shall not exceed twenty-four (24) inches for clean sand or gravel and eight (8) inches for earth.

3405.3.2.2 Base course: A four (4) inch thick base course shall be placed on the prepared subgrade, consisting of clean graded sand, gravel, crushed stone or crushed blast-furnace slag passing a two (2) inch sieve and retained on a one-quarter (1/4) inch sieve. An approved vapor barrier with joints lapped six (6) inches shall be placed between the base course and the concrete floor slab.

Exception: The vapor barrier may be omitted where approved by the building official, based upon local site condition.

3405.4 Metal: Steel structural elements in floors may be either hot-rolled structural steel shapes or members cold formed to shape from steel sheet strip or plate, or a fabricated combination thereof. Members shall be straight and free of any defects which would significantly affect their structural performance.

3405.4.1 Span: The allowable span for steel girders or beams and the tributary area for steel columns in floors shall not exceed the values set forth in Tables 3405-6.

3405.4.2 Structural elements: Aluminum structural elements in floors shall be constructed of materials and designed in accordance with Reference Standard RS-21-5.

3405.5 Particleboard: Particleboard floor underlayment shall conform to Type 1-B-1 of the standards set forth in Standard RS-21-5. Underlayment shall be not less than one-quarter (1/4) inch in thickness and shall be identified by the grade mark of an approved inspection agency.

Underlayment shall be installed in accordance with this code and as recommended by the manufacturer.

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**TABLE 3405-1
ALLOWABLE SPANS FOR FLOOR JOISTS**

Joist size spacing (in) (in)		Modulus of Elasticity, "E", in 1,000,000 psi									
		0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3
2 x 6	12.0	7.5 440	8.0 510	8.6 570	8.11 640	9.4 700	9.9 750	10.1 810	10.5 860	10.9 910	11.0 960
	13.7	7.1 460	7.8 530	8.2 600	8.7 670	8.11 730	9.4 790	9.8 840	10.0 900	10.3 950	10.6 1010
	16.0	6.9 480	7.3 560	7.9 630	8.2 700	8.6 770	8.10 830	9.2 890	9.6 950	9.9 1000	10.0 1060
	19.2	6.4 510	6.10 600	7.3 670	7.8 740	8.0 810	8.4 880	8.8 940	8.11 1010	9.2 1070	9.5 1130
	24.0	5.11 550	6.4 640	6.9 720	7.1 800	7.5 880	7.9 950	8.0 1020	8.3 1080	8.6 1150	8.9 1210
	32.0					6.9 960	7.0 1040	7.3 1110	7.6 1190	7.9 1270	7.11 1330
2 x 8	12.0	9.10 440	10.7 510	11.3 570	11.10 640	12.4 700	12.10 750	13.4 810	13.9 860	14.2 910	14.6 960
	13.7	9.4 460	10.1 530	10.9 600	11.4 670	11.10 730	12.3 790	12.9 840	13.2 900	13.6 950	13.11 1010
	16.0	8.11 480	9.7 560	10.2 630	10.9 700	11.3 770	11.8 830	12.1 890	12.6 950	12.10 1000	13.2 1060
	19.2	8.5 510	9.0 600	9.7 670	10.1 740	10.7 810	11.0 880	11.4 940	11.9 1010	12.1 1070	12.5 1130
	24.0	7.9 550	8.5 640	8.11 720	9.4 800	9.10 880	10.2 950	10.7 1020	10.11 1080	11.3 1150	11.6 1210
	32.0					8.11 970	9.3 1040	9.7 1120	9.11 1200	10.2 1260	10.8 1340
2 x 10	12.0	12.6 440	13.6 510	14.4 570	15.1 640	15.9 700	16.5 750	17.0 810	17.6 860	18.0 910	18.6 960
	13.7	11.11 460	12.11 530	13.8 600	14.5 670	15.1 730	15.8 790	16.3 840	16.9 900	17.3 950	17.9 1010
	16.0	11.4 480	12.3 560	13.0 630	13.8 700	14.4 770	14.11 830	15.5 890	15.11 950	16.5 1000	16.10 1060
	19.2	10.8 510	11.6 600	12.3 670	12.11 740	13.6 810	14.0 880	14.6 940	15.0 1010	15.5 1070	15.10 1130
	24.0	9.11 550	10.8 640	11.4 720	11.11 800	12.6 880	13.0 950	13.6 1020	13.11 1080	14.4 1150	14.8 1210
	32.0					11.4 960	11.10 1050	12.3 1120	12.8 1200	13.0 1260	13.4 1330
2 x 12	12.0	15.2 440	16.5 510	17.5 570	18.4 640	19.2 700	19.11 750	20.8 810	21.4 860	22.11 910	22.6 960
	13.7	14.7 460	15.8 530	16.8 600	17.6 670	18.4 730	19.1 790	19.9 840	20.5 900	21.0 950	21.7 1010
	16.0	13.10 480	14.11 560	15.10 630	16.8 700	17.5 770	18.1 830	18.9 890	19.4 950	19.11 1000	20.6 1060
	19.2	13.0 510	14.0 600	14.11 670	15.8 740	16.5 810	17.0 880	17.8 940	18.3 1010	18.9 1070	19.3 1130
	24.0	12.1 550	13.0 640	13.10 720	14.7 800	15.2 880	15.10 950	16.5 1020	16.11 1080	17.5 1150	17.11 1210
	32.0					13.10 970	14.4 1040	14.11 1130	15.4 1190	15.10 1270	16.3 1340

Note: The extreme fiber stress in bending, " F_b ", in pounds per sq. inch is shown below each span.

(All rooms used for sleeping areas and attic floors)

Strength - Live load of 30 psf plus dead load of 10 psf determines the fiber stress shown.

DESIGN CRITERIA: Deflection - For 30 psf live load. Limited to span in inches divided by 360.

ONE AND TWO-FAMILY DWELLING

TABLE 3405-1 (continued)
ALLOWABLE SPANS FOR FLOOR JOISTS

Joist Size Spacing (in) (in)		Modulus of Elasticity, "E", in 1,000,000 psi								
		1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4
2 x 6	12.0	11.3 1010	11.7 1060	11.10 1100	12.0 1150	12.3 1200	12.6 1240	12.9 1280	13.1 1370	13.6 1450
	13.7	10.10 1060	11.1 1110	11.3 1160	11.8 1200	11.9 1250	11.11 1300	12.2 1340	12.7 1430	12.11 1510
	16.0	10.3 1110	10.6 1160	10.9 1220	10.11 1270	11.2 1320	11.4 1360	11.7 1410	11.11 1500	12.3 1590
	19.2	9.8 1180	9.10 1240	10.1 1290	10.4 1350	10.6 1400	10.8 1450	10.10 1500	11.3 1600	11.7 1690
	24.0	8.11 1270	9.2 1330	9.4 1390	9.7 1450	9.9 1510	9.11 1560	10.1 1620	10.5 1720	10.9 1820
	32.0	8.2 1410	8.4 1470	8.6 1530	8.8 1590	8.10 1650	9.0 1710	9.2 1780	9.6 1910	9.9 2010
2 x 8	12.0	14.11 1010	15.3 1060	15.7 1100	15.10 1150	16.2 1200	16.6 1240	16.9 1280	17.4 1370	17.10 1450
	13.7	14.3 1060	14.7 1110	14.11 1160	15.2 1200	15.6 1250	15.9 1300	16.0 1340	16.7 1430	17.0 1510
	16.0	13.6 1110	13.10 1160	14.2 1220	14.5 1270	14.8 1320	15.0 1360	15.3 1410	15.9 1500	16.2 1590
	19.2	12.9 1180	13.0 1240	13.4 1290	13.7 1350	13.10 1400	14.1 1450	14.4 1500	14.9 1600	15.3 1690
	24.0	11.10 1270	12.1 1330	12.4 1390	12.7 1450	12.10 1510	13.1 1560	13.4 1620	13.9 1720	14.2 1820
	32.0	10.9 1410	11.0 1470	11.3 1540	11.5 1590	11.8 1660	11.11 1730	12.1 1780	12.6 1900	12.10 2010
2 x 10	12.0	19.0 1010	19.5 1060	19.10 1100	20.3 1150	20.8 1200	21.0 1240	21.5 1280	22.1 1370	22.9 1450
	13.7	18.2 1060	18.7 1110	19.0 1160	19.4 1200	19.9 1250	20.1 1300	20.5 1340	21.1 1430	21.9 1510
	16.0	17.3 1110	17.8 1160	18.0 1220	18.5 1270	18.9 1320	19.1 1360	19.5 1410	20.1 1500	20.8 1590
	19.2	16.3 1180	16.7 1240	17.0 1290	17.4 1350	17.8 1400	18.0 1450	18.3 1500	18.10 1600	19.5 1690
	24.0	15.1 1270	15.5 1330	15.9 1390	16.1 1450	16.5 1510	16.8 1560	17.0 1620	17.6 1720	18.0 1820
	32.0	13.8 1400	14.0 1470	14.4 1540	14.7 1590	14.11 1660	15.2 1720	15.5 1780	15.11 1890	16.5 2020
2 x 12	12.0	23.1 1010	23.7 1060	24.2 1100	24.8 1150	25.1 1200	25.7 1240	26.0 1280	26.10 1370	27.8 1450
	13.7	22.1 1060	22.7 1110	23.1 1160	23.7 1200	24.0 1250	24.5 1300	24.10 1340	25.8 1430	26.5 1510
	16.0	21.0 1110	21.6 1160	21.11 1220	22.5 1270	22.10 1320	23.3 1360	23.7 1410	24.5 1500	25.1 1590
	19.2	19.9 1180	20.2 1240	20.8 1290	21.1 1350	21.6 1400	21.10 1450	22.3 1500	22.11 1600	23.7 1690
	24.0	18.4 1270	18.9 1330	19.2 1390	19.7 1450	19.11 1510	20.3 1560	20.8 1620	21.4 1720	21.11 1820
	32.0	16.8 1400	17.0 1460	17.5 1530	17.9 1590	18.1 1650	18.5 1720	18.9 1780	19.4 1890	19.11 2010

HOW TO USE TABLES: Enter Table with span of joists (upper figure in each square). Determine size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

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TABLE 3405-2
ALLOWABLE SPANS FOR FLOOR JOISTS
40 Lbs. Per Sq. Ft. Live Load

Joist		Modulus of Elasticity, "E", in 1,000,000 psi									
Size (in)	Spacing (in)	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3
2 x 6	12.0	6.9 450	7.3 520	7.9 590	8.2 660	8.6 720	8.10 780	9.2 830	9.6 890	9.9 940	10.0 990
	13.7	6.6 470	7.0 550	7.5 620	7.9 690	8.2 750	8.6 810	8.9 870	9.1 930	9.4 980	9.7 1040
	16.0	6.2 500	6.7 580	7.0 650	7.5 720	7.9 790	8.0 860	8.4 920	8.7 980	8.10 1040	9.1 1090
	19.2	5.9 530	6.3 610	6.7 680	7.0 770	7.3 840	7.7 910	7.10 970	8.1 1040	8.4 1100	8.7 1180
	24.0	5.4 570	5.9 660	6.2 750	6.6 830	6.9 900	7.0 980	7.3 1050	7.6 1120	7.9 1190	7.11 1250
	32.0					6.2 1010	6.5 1080	6.7 1150	6.10 1230	7.0 1300	7.3 1390
2 x 8	12.0	8.11 450	9.7 520	10.2 590	10.9 660	11.3 720	11.8 780	12.1 830	12.6 890	12.10 940	13.2 990
	13.7	8.6 470	9.2 550	9.9 620	10.3 690	10.9 750	11.2 810	11.7 870	11.11 930	12.3 980	12.7 140
	16.0	8.1 500	8.9 580	9.3 650	9.9 720	10.2 790	10.7 850	11.0 920	11.4 980	11.8 1040	12.0 1090
	19.2	7.7 530	8.2 610	8.9 680	9.2 770	9.7 840	10.0 910	10.4 970	10.8 1040	11.0 1100	11.3 1180
	24.0	7.1 570	7.7 660	8.1 750	8.6 830	8.11 900	9.3 980	9.7 1050	9.11 1120	10.2 1190	10.6 1250
	32.0					8.1 990	8.5 1060	8.9 1170	9.0 1230	9.3 1300	9.6 1370
2 x 10	12.0	11.4 450	12.3 520	13.0 590	13.8 660	14.4 720	14.11 780	15.5 830	15.11 890	16.5 940	16.10 990
	13.7	10.10 470	11.8 550	12.5 620	13.1 690	13.8 750	14.3 810	14.9 870	15.3 930	15.8 980	16.1 1040
	16.0	10.4 500	11.1 580	11.10 650	12.5 720	13.0 790	13.6 850	14.0 920	14.6 980	14.11 1040	15.3 1090
	19.2	9.9 530	10.6 610	11.1 680	11.8 770	12.3 840	12.9 910	13.2 970	13.7 1040	14.0 1100	14.5 1180
	24.0	9.0 570	9.9 660	10.4 750	10.10 830	11.4 900	11.10 980	12.3 1050	12.8 1120	13.0 1190	13.4 1250
	32.0					10.4 1000	10.9 1080	11.1 1150	11.6 1240	11.10 1310	12.2 1380
2 x 12	12.0	13.10 450	14.11 520	15.10	16.6 660	17.5 720	18.1 780	18.9 830	19.4 890	19.11 940	20.6 990
	13.7	13.3 470	14.3 550	15.2 620	15.11 690	16.6 750	17.4 810	17.11 870	18.6 930	19.1 980	19.7 1040
	16.0	12.7 500	13.6 580	14.4 650	15.2 720	15.10 790	16.5 860	17.0 920	17.7 980	18.1 1040	18.7 1090
	19.2	11.10 530	12.9 610	13.6 680	14.3 770	14.11 840	15.6 910	16.0 970	16.7 1040	17.0 1100	17.6 1180
	24.0	11.0 570	11.10 660	12.7 750	13.3 830	13.10 900	14.4 980	14.11 1050	15.4 1120	15.10 1190	16.3 1250
	32.0					12.7 1000	13.1 1080	13.6 1150	13.11 1220	14.4 1300	14.9 1380

Note: The extreme fiber stress in bending, "F", in pounds per sq. inch is shown below each span. (All rooms except those used for sleeping areas and attic floors) Strength - Live load of 30 psf plus dead load of 10 psf determines the fiber stress shown.

DESIGN CRITERIA: Deflection - For 40 psf live load. Limited to span in inches divided by 360.

TABLE 3405-2 (continued)
ALLOWABLE SPANS FOR FLOOR JOISTS

HOW TO USE THE TABLE: Enter Table with span of joists (upper figure in each square). Determine size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

Joist Size Spacing (In) (In)		Modulus of Elasticity, "E", in 1,000,000 psi								
		1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4
2 x 6	12.0	10-3 1040	10-6 1090	10-9 1140	10-11 1190	11-2 1230	11-4 1280	11-7 1320	11-11 1410	12-3 1490
	13.7	9-10 1090	10-0 1140	10-3 1190	10-6 1240	10-8 1290	10-10 1340	11-1 1380	11-5 1470	11-9 1560
	16.0	9-4 1150	9-6 1200	9-9 1250	9-11 1310	10-2 1360	10-4 1410	10-5 1460	10-10 1550	11-2 1640
	19.2	8-9 1220	9-0 1280	9-2 1330	9-4 1390	9-6 1440	9-8 1500	9-10 1550	10-2 1650	10-6 1750
	24.0	8-2 1310	8-4 1380	8-6 1440	8-8 1500	8-10 1550	9-0 1610	9-2 1670	9-6 1780	9-9 1880
	32.0	7-5 1450	7-7 1520	7-9 1590	7-11 1660	8-0 1690	8-2 1760	8-4 1840	8-7 1950	8-10 2060
2 x 8	12.0	3-6 1040	13-10 1090	14-2 1140	14-5 1190	14-8 1230	15-0 1280	15-3 1320	15-9 1410	16-2 1400
	13.7	12-11 1090	13-3 1140	13-6 1190	13-10 1240	14-1 1290	14-4 1340	14-7 1380	15-0 1470	15-6 1560
	16.0	12-3 1150	12-7 1200	12-10 1250	13-1 1310	13-4 1360	13-7 1410	13-10 1460	14-3 1550	14-8 1640
	19.2	11-7 1220	11-10 1280	12-1 1330	12-4 1390	12-7 1440	12-10 1500	13-0 1550	13-5 1650	13-10 1750
	24.0	10-9 1310	11-0 1380	11-3 1440	11-5 1500	11-8 1550	11-11 1610	12-1 1670	12-6 1780	12-10 1880
	32.0	9-9 1450	10-0 1520	10-2 1570	10-5 1650	10-7 1700	10-10 1790	11-0 1840	11-4 1950	11-8 2070
2 x 10	12.0	17-3 1040	17-8 1090	18-0 1140	18-5 1190	18-9 1230	19-1 1280	19-5 1320	20-1 1410	20-8 1490
	13.7	16-6 1090	16-11 1140	17-3 1190	17-7 1240	17-11 1290	18-3 1340	18-7 1380	19-2 1470	19-9 1560
	16.0	15-8 1150	16-0 1200	16-5 1250	16-9 1310	17-0 1360	17-4 1410	17-8 1460	18-3 1550	18-9 1640
	19.2	14-9 1220	15-1 1280	15-5 1330	15-9 1390	16-0 1440	16-4 1500	16-7 1550	17-2 1650	17-8 1750
	24.0	13-8 1310	14-0 1380	14-4 1440	14-7 1500	14-11 1550	15-2 1610	15-5 1670	15-11 1780	16-5 1880
	32.0	12-5 1440	12-9 1520	13-0 1580	13-3 1640	13-6 1700	13-9 1770	14-0 1830	14-6 1970	14-11 2080
2 x 12	12.0	21-0 1040	21-6 1090	21-11 1140	22-5 1190	22-10 1230	23-3 1280	23-7 1320	24-5 1410	25-1 1490
	13.7	20-1 1090	20-6 1140	21-0 1190	21-5 1240	21-10 1290	22-3 1340	22-7 1380	23-4 1470	24-0 1560
	16.0	19-1 1150	19-6 1200	19-11 1250	20-4 1310	20-9 1360	21-1 1410	21-6 1460	22-2 1550	22-10 1640
	19.2	17-11 1220	18-4 1280	18-9 1330	19-2 1390	19-6 1440	19-10 1500	20-2 1550	20-10 1650	21-6 1750
	24.0	16-8 1310	17-0 1380	17-5 1440	17-9 1500	18-1 1550	18-5 1610	18-9 1670	19-4 1780	19-11 1880
	32.0	15-2 1450	15-6 1520	15-10 1580	16-2 1650	16-5 1700	16-9 1770	17-0 1830	17-7 1950	18-1 2070

TABLE 3405-3
ALLOWABLE SPANS FOR PLYWOOD FLOOR AND ROOF SHEATHING
CONTINUOUS OVER TWO OR MORE SPANS AND FACE GRAIN
PERPENDICULAR TO SUPPORTS¹ (SPAN IN INCHES)

Panel Identification Index ² Roof Span, Roof/floor span	Thickness (inches)	Roof				Floor
		Maximum span (inches)		Load (psf)		Maximum Span ⁵ (inches)
		Edges blocked ³	Edges unblocked	Total load	Live load	
12/0	5/16	12	12	155	150	0
16/0	5/16,3/8	16	16	95	75	0
20/0	5/16,3/8	20	20	75	65	0
24/0	3/8	24	20	65	50	0
24/0	1/2	24	24	65	50	0
30/12	5/8	30	26	70	50	12 ⁶
32/16	1/2,5/8	32	28	55	40	16 ⁷
36/16	3/4	36	30	55	50	16 ⁷
42/20	5/8,3/4,7/8	42	32	40 ⁴	35 ⁴	20 ⁷
48/24	3/4,7/8	48	36	40 ⁴	35 ⁴	24

Notes to Table 3405-3

Note 1. These values apply for C-D and C-C, Structural I and II grades only. Spans shall be limited to values shown because of possible effect of concentrated loads.

Note 2. Identification Index appears on all panels in the construction grades listed in footnote (1). Allowable uniform roof load deflection limitation: 1/180th of the span under live load plus dead load, 1/240th under live load only.

Note 3. Edges may be blocked with lumber or other approved type of edge support.

Note 4. For roof live load of forty (40) psf or total load of fifty-five (55) psf, decrease spans by thirteen(13) percent or use panel with next greater Identification Index.

Note 5. Plywood edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finish floor is 25/32 inch woodstrip. Allowable uniform load based on deflection of 1/360 of span is one hundred sixty-five (165) psf.

Note 6. May be sixteen (16) inches, if 25/32 inch woodstrip flooring is installed at right angles to joists.

Note 7. May be twenty-four (24) inches if 25/32 inch wood strip flooring is installed at right angles to joists.

TABLE 3405-4
PLYWOOD COMBINATION SUBFLOOR-UNDERLAYMENT

**ALLOWABLE SPAN FOR PLYWOOD COMBINATION
SUBFLOOR UNDERLAYMENT¹**

**PLYWOOD CONTINUOUS OVER TWO (2) OR MORE
SPANS AND FACE GRAIN PERPENDICULAR
TO SUPPORTS (THICKNESS IN INCHES)**

Species groups	Maximum spacing of joists (inches)		
	16	20	24
1	1/2	5/8	3/4
2,3	5/8	3/4	7/8
4	3/4	7/8	1

Notes to Table 3405-4

Note 1. Applicable to Underlayment Grade, C-C (Plugged) and all grades of sanded exterior type plywood. Spans limited to values shown because of possible effect of concentrated loads. Allowable uniform load based on deflection of 1/360 of span is one hundred twenty-five (125) psf. Plywood edges shall have approved tongue-and-groove joint* or shall be supported with blocking, unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finish floor is 25/32 inch woodstrip. If wood strips are perpendicular to supports, thicknesses shown for sixteen (16) inch and twenty (20) inch spans may be used on twenty-four (24) inch span. Except for one-half (1/2) inch, underlayment grade and C-C (Plugged) panels may be of nominal thickness 1/32 inch less than the nominal thicknesses shown when marked with the reduced thickness.

TABLE 3405-5
MINIMUM THICKNESS OF FLOOR SHEATHING

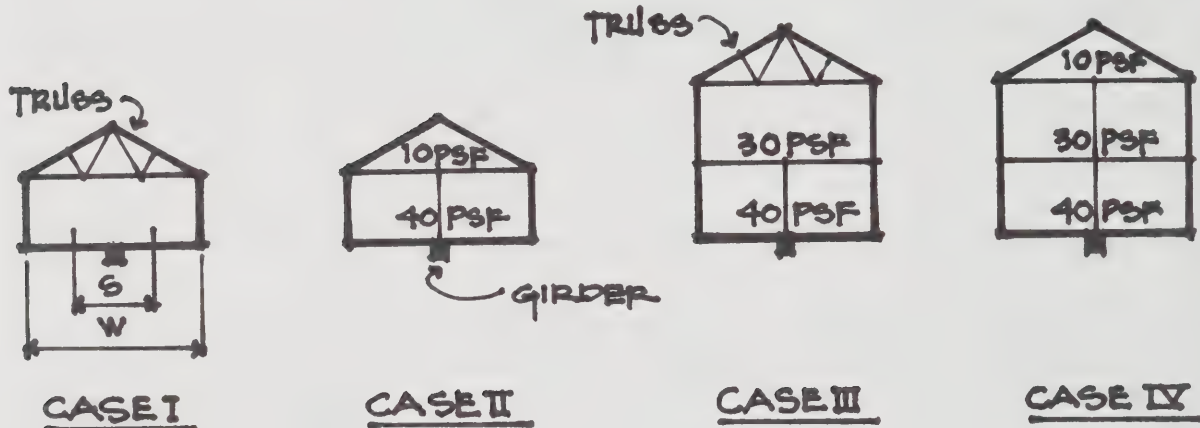
Joist Spacing (inches)	Minimum Net Thickness (inches)	
	Perpendicular to Joist	Diagonal to Joist
24	11/16	3/4
16	5/8	5/8

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TABLE 3405-6
COLUMN SPACINGS UNDER GIRDERS

Column Sizes - 4" x 4" or 3½" diameter steel

Footing Size - 2'-6" x 2'-6" x 10" d



Girder Size	S-13				S-14				S-15				S-16			
F _b =	1000	1200	1400	1600	1000	1200	1400	1600	1000	1200	1400	1600	1000	1200	1400	1600
CASE I																
4x10, 3-2x8	6-4	7-0	7-6	8-0	6-1	6-8	7-3	7-8	5-10	6-5	7-0	7-5	5-8	6-3	6-9	7-3
4x12, 3-2x10	8-1	8-9	9-6	10-3	7-9	8-6	9-3	9-10	7-6	8-3	8-10	9-6	7-3	8-0	8-8	9-1
6x12, 3-2x12	9-9	10-9	11-7	12-5	9-6	10-4	11-4	12-0	9-1	10-0	10-9	11-7	8-9	9-8	9-8	11-3
CASE II																
4x10, 3-2x8	5-6	6-0	6-6	7-0	5-4	5-9	6-4	6-8	5-1	5-7	6-1	6-6	5-0	5-6	5-10	6-4
4x12, 3-2x10	7-0	7-9	8-5	9-0	6-9	7-6	8-1	8-8	6-7	7-3	7-9	8-3	6-4	7-0	7-6	8-1
6x12, 3-2x12	8-8	9-5	10-3	10-10	8-1	9-1	9-9	10-6	8-0	8-9	9-6	10-1	7-9	8-6	9-2	9-9
CASE III																
4x10, 3-2x8	4-8	5-1	5-7	6-0	4-6	5-0	5-3	5-8	4-3	4-9	5-2	5-6	4-3	4-8	5-0	5-3
4x12, 3-2x10	6-0	6-7	7-1	7-7	5-9	6-4	6-9	7-4	5-7	6-1	6-8	7-1	5-5	5-10	6-5	6-9
6x12, 3-2x12	7-4	8-0	8-8	9-3	7-0	7-8	8-4	8-10	6-9	7-6	8-0	8-8	6-7	7-3	7-9	8-4
CASE IV																
4x10, 3-2x8	4-4	4-9	5-1	5-6	4-2	4-7	5-0	5-4	4-0	4-4	4-9	5-1	3-10	4-4	4-8	5-0
4x12, 3-2x10	5-6	6-1	6-8	7-0	5-3	5-10	6-4	6-9	5-2	5-8	6-1	6-6	5-0	5-6	5-10	6-4
6x12, 3-2x12	6-9	7-5	8-0	8-7	6-6	7-1	7-8	8-3	6-4	6-10	7-6	8-0	6-1	6-8	7-3	7-9
STEEL GIRDERS BETWEEN SUPPORTS (A - 36 STEEL)																
8' - 0"	6W8.5				6W8.5				6W8.5				6W8.5			
10' - 0"	8W10				8W10				8W10				8W15			
12' - 0"	8W15				8W15				10W15				10W15			
14' - 0"	10W15				10W15				10W17				10W17			

SECTION 3406.0 ROOF-CEILING CONSTRUCTION

3406.1 General: Roofs shall be constructed in accordance with Tables 3406-1 through 3406-6, the energy requirements in Table 3423-1, and nailed in accordance with Table 3403-2.

3406.1.1 Specifications: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

3406.2 Wood

3406.2.1 Identification: All load-bearing lumber, plywood and particleboard shall conform to applicable standards or grading rules and be identified by a grade mark, or certificate or inspection issued by an approved lumber grading or inspection bureau or agency.

Exception: Native lumber - Items 3406.2.1 Identification and 3406.2.2 Grade of this section shall be subject to the provisions of Section 3403.3 for native lumber.

3406.2.2 Grade: All rafters and ceiling joists shall be of No. 3 or Standard Grade lumber or equivalent. Blocking and sheathing may be of No. 4 or Utility Grade lumber or equivalent.

3406.2.3 Allowable spans: The unsupported spans of rafters and ceiling joists shall not exceed the values set forth in Tables 3406-1, 3406-2, 3406-3, 3406-4, 3406-5 and 3406-6. The modulus of elasticity, "E", and the actual stress in bearing, "Fb", shall not exceed the values given in the tables.

3406.2.3.1 Other criteria: The allowable spans and minimum grades for plywood roof sheathing shall not exceed the values set forth in Table 3405-3. The allowable span for board type roof sheathing shall not exceed twenty-four (24) inches and shall be five-eighths (5/8) inch minimum net thickness for solid sheathing and three-quarter (3/4) inch minimum net thickness for spaced sheathing.

3406.2.4 Framing: Rafters shall be framed directly opposite each other at the ridge or there shall be a ridge board at least one (1) inch nominal thickness at all ridges and not less in depth than the size of the rafter. At all valleys and hips there shall be a single valley or hip rafter not less than two (2) inches nominal thickness and not less in depth than the size of the rafter.

3406.3 Metal: Steel structural elements in roof-ceiling construction may be either hot-rolled structural steel shapes or members cold formed to shape from steel strip or plate or a fabricated combination thereof.

Members shall be straight and free of any defects which would significantly affect their structural performance. Steel girders, trusses or beams in roof-ceiling construction shall be designed in accordance with the applicable standards in this article.

3406.3.1 Aluminum elements: Aluminum structural elements in roof-ceiling systems shall be constructed of materials and designed in accordance with the applicable reference standards of this article.

3406.4 Ceiling finishes: Ceilings shall be installed in accordance with recommended engineering practice and applicable reference standards.

3406.5 Attic access: An accessible attic opening not less than twenty-two (22) inches by thirty (30) inches shall be provided to any attic area with clear headroom of three (3) feet or more.

TABLE 3406-1
ALLOWABLE SPANS FOR CEILING JOISTS

20 Lbs. per Sq.Ft. Live Load

(Limited attic storage where development of future rooms is not possible)

(Drywall Ceiling)

HOW TO USE TABLES: Enter Table Deflection - for 20 lbs./sq.ft. live load. Limited to span in inches divided by 240. Strength - Live load of 20 lbs./sq. ft. plus dead load of 10 lbs./sq. ft. determines required fiber stress value.

DESIGN CRITERIA: span of joists (upper figure in each square). Determine the size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

Joist size spacing (in)		Modulus of Elasticity, "E", in 1,000,000 psi													
		0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2
2 x 4	12.0	7-10 900	8-1 970	8-5 1040	8-8 1110	8-11 1170	9-2 1240	9-5 1300	9-8 1360	9-10 1420	10-0 1480	10-3 1540	10-5 1600	10-7 1650	10-11 1760
	13.7	7-6 940	7-9 1010	8-1 1090	8-4 1160	8-7 1230	8-9 1300	9-0 1360	9-3 1420	9-5 1400	9-7 1550	9-9 1610	10-0 1670	10-2 1730	10-6 1840
	16.0	7-1 990	7-5 1070	7-8 1140	7-11 1220	8-1 1290	8-4 1360	8-7 1430	8-9 1500	8-11 1570	9-1 1630	9-4 1690	9-6 1760	9-8 1820	9-11 1940
	19.2	6-8 1050	6-11 1130	7-2 1220	7-5 1300	7-8 1370	7-10 1450	8-1 1520	8-3 1590	8-5 1660	8-7 1730	8-9 1800	8-11 1870	9-1 1930	9-4 2060
	24.0	6-2 1130	6-5 1220	6-8 1310	6-11 1400	7-1 1480	7-3 1560	7-6 1640	7-8 1720	7-10 1790	8-0 1870	8-1 1940	8-3 2010	8-5 2080	8-8 2220
2 x 6	12.0	12-3 900	12-9 970	13-3 1040	13-8 1110	14-1 1170	14-5 1240	14-9 1300	15-2 1360	15-6 1420	15-9 1480	16-1 1540	16-4 1600	16-8 1650	17-2 1760
	13.7	11-9 940	12-3 1010	12-8 1090	13-1 1160	13-5 1230	13-10 1300	14-2 1360	14-6 1420	14-9 1490	15-1 1550	15-5 1610	15-9 1670	15-11 1730	16-5 1840
	16.0	11-2 900	11-7 1070	12-0 1140	12-5 1220	12-9 1290	13-1 1360	13-5 1430	13-9 1500	14-1 1470	14-4 1630	14-7 1690	14-11 1760	15-2 1820	15-7 1940
	19.2	10-6 1050	10-11 1130	11-4 1220	11-8 1300	12-0 1370	12-4 1450	12-8 1520	12-11 1590	13-3 1660	13-6 1730	13-9 1800	14-0 1870	14-3 1930	14-8 2060
	24.0	9-9 1130	10-2 1220	10-6 1310	10-10 1400	11-2 1480	11-5 1560	11-9 1640	12-0 1720	12-3 1790	12-6 1870	12-9 1940	13-0 2010	13-3 2080	13-8 2220
2 x 8	12.0	16-2 900	16-10 970	17-5 1040	18-0 1110	18-6 1170	19-0 1240	19-6 1300	19-11 1360	20-5 1420	20-10 1480	21-2 1540	21-7 1600	21-11 1650	22-8 1760
	13.7	15-6 940	16-1 1010	15-8 1090	17-2 1160	17-9 1230	18-2 1300	18-8 1360	19-1 1420	19-6 1490	19-11 1550	20-3 1610	20-8 1670	21-0 1730	21-8 1840
	16.0	14-8 900	15-3 1070	15-10 1140	16-4 1220	16-10 1290	17-3 1360	17-9 1430	18-2 1500	18-6 1570	18-11 1630	19-3 1690	19-7 1700	19-11 1820	20-7 1940
	19.2	13-10 1050	14-5 1130	14-11 1220	15-5 1300	15-10 1370	16-3 1450	16-8 1520	17-1 1590	17-5 1660	17-9 1730	18-2 1800	18-5 1870	18-9 1930	19-5 2060
	24.0	12-10 1130	13-4 1220	13-10 1310	14-3 1400	14-8 1480	15-1 1560	15-6 1640	15-10 1720	16-2 1790	16-6 1870	16-10 1940	17-2 2010	17-5 2080	18-0 2220
2 x 10	12.0	20-8 200	21-6 970	22-3 1040	22-11 1110	23-8 1170	24-3 1240	24-10 1300	25-5 1360	26-0 1420	26-6 1480	27-1 1540	27-6 1600	28-0 1650	28-11 1760
	13.7	19-9 940	20-6 1010	21-3 1090	21-11 1160	22-7 1230	23-3 1300	23-9 1360	24-4 1420	24-10 1490	25-5 1550	25-10 1610	26-4 1670	26-10 1730	27-8 1840
	16.0	18-9 990	19-6 1070	20-2 1140	20-10 1220	21-6 1290	22-1 1360	22-7 1430	23-2 1500	23-8 1570	24-1 1630	24-7 1690	25-0 1760	25-5 1820	26-3 1940
	19.2	17-8 1050	18-4 1130	19-0 1220	19-7 1300	20-2 1370	20-9 1450	21-3 1520	21-9 1590	22-3 1660	22-8 1730	23-2 1800	23-7 1870	23-11 1930	24-9 2060
	24.0	16-5 1130	17-0 1220	17-8 1310	18-3 1400	18-9 1480	19-3 1560	19-9 1640	20-2 1720	20-8 1790	21-1 1870	21-6 1940	21-10 2010	22-3 2080	22-11 2220

Note: The required extreme fiber stress in bending, "F_b", in pounds per sq. inch is shown below each span.

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TABLE 3406-2
ALLOWABLE SPANS FOR CEILING JOISTS

10 Lbs. per Sq.Ft. Live Load
(No attic storage and roof slope not steeper than 3 in 12)
(Drywall Ceiling)

DESIGN CRITERIA: Deflection - for 10 lbs./sq.ft. live load. Limited to span in inches divided by 240. Strength - Live load of 10 lbs./sq. ft. plus dead load of 10 lbs./sq. ft. determines required fiber stress value.

HOW TO USE TABLES: Enter Table span of joists (upper figure in each square). Determine the size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

Joist size spacing (in) (in)		Modulus of Elasticity, "E", in 1,000,000 psi													
		0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2
2 x 4	12.0	9-10 710	10-3 770	10-7 830	10-11 880	11-3 930	11-7 980	11-10 1030	12-2 1080	12-5 1130	12-8 1180	12-11 1220	13-2 1270	13-4 1310	13-9 1400
	13.7	9-5 740	9-9 800	10-2 860	10-6 920	10-9 970	11-1 1030	11-4 1080	11-7 1130	11-10 1180	12-1 1230	12-4 1280	12-7 1320	12-9 1370	13-2 1460
	16.0	8-11 780	9-4 850	9-8 910	9-11 970	10-3 1030	10-6 1080	10-9 1140	11-0 1190	11-3 1240	11-6 1290	11-9 1340	11-11 1390	12-2 1440	12-6 1540
	19.2	8-5 830	8-9 900	9-1 970	9-4 1030	9-8 1090	9-11 1150	10-2 1210	10-4 1270	10-7 1320	10-10 1380	11-0 1430	11-3 1480	11-5 1530	11-9 1630
	24.0	7-10 900	8-1 970	8-5 1040	8-8 1110	8-11 1170	9-2 1240	9-5 1300	9-8 1360	9-10 1420	10-0 1480	10-3 1540	10-5 1600	10-7 1650	10-11 1760
2 x 6	12.0	15-6 710	16-1 770	16-8 830	17-2 880	17-8 930	18-2 980	18-8 1030	19-1 1080	19-6 1130	19-11 1180	20-3 1220	20-8 1270	21-0 1310	21-8 1400
	13.7	14-9 740	15-5 800	15-11 860	16-5 920	16-11 970	17-5 1030	17-10 1080	18-3 1130	18-8 1180	19-0 1230	19-5 1280	19-9 1320	20-1 1370	20-9 1460
	16.0	14-1 780	14-7 850	15-2 910	15-7 970	16-1 1030	16-6 1080	16-11 1140	17-4 1190	17-8 1240	18-1 1290	18-5 1340	18-9 1390	19-1 1440	19-8 1540
	19.2	13-3 830	13-9 900	14-3 970	14-8 1030	15-2 1090	15-7 1150	15-11 1210	16-4 1270	16-8 1320	17-0 1380	17-4 1430	17-8 1480	17-11 1530	18-6 1630
	24.0	12-3 900	12-9 970	13-3 1040	13-8 1110	14-1 1170	14-5 1240	14-9 1300	15-2 1360	15-6 1420	15-9 1480	16-1 1540	16-4 1600	16-8 1650	17-2 1760
2 x 8	12.0	20-5 710	21-2 770	21-11 830	22-8 880	23-4 930	24-0 980	24-7 1030	25-2 1080	25-8 1130	26-2 1180	26-9 1220	27-2 1270	27-8 1310	28-7 1400
	13.7	19-6 740	20-3 800	21-0 850	21-8 920	22-4 970	22-11 1030	23-6 1080	24-0 1130	24-7 1180	25-1 1230	25-7 1280	26-0 1320	26-6 1370	27-4 1460
	16.0	18-6 780	19-3 850	19-11 910	20-7 970	21-2 1030	21-9 1080	22-4 1140	22-10 1190	23-4 1240	23-10 1290	24-3 1340	24-8 1390	25-2 1440	25-11 1540
	19.2	17-5 830	18-2 900	18-9 970	19-5 1030	19-11 1090	20-6 1150	21-0 1210	21-6 1270	21-11 1320	22-5 1380	22-10 1430	23-3 1480	23-8 1530	24-5 1630
	24.0	16-2 900	16-10 970	17-5 1040	18-0 1110	18-6 1170	19-0 1240	19-6 1300	19-11 1360	20-5 1420	20-10 1480	21-2 1540	21-7 1600	21-11 1650	22-8 1760
2 x 10	12.0	26-0 710	27-1 770	28-0 830	28-11 880	29-9 930	30-7 980	31-4 1030	32-1 1080	32-9 1130	33-5 1180	34-1 1220	34-8 1270	35-4 1310	36-5 1400
	13.7	24-10 740	25-10 800	26-10 860	27-8 920	28-6 970	29-3 1030	30-0 1080	30-8 1130	31-4 1180	32-0 1230	32-7 1280	33-2 1320	33-9 1370	34-10 1460
	16.0	23-8 780	24-7 850	25-5 910	26-3 970	27-1 1030	27-9 1080	28-6 1140	29-2 1190	29-9 1240	30-5 1290	31-0 1340	31-6 1390	32-1 1440	33-1 1540
	19.2	22-3 830	23-2 900	23-11 970	24-9 1030	25-5 1090	26-2 1150	26-10 1210	27-5 1270	28-0 1320	28-7 1380	29-2 1430	29-8 1480	30-2 1530	31-2 1630
	24.0	20-8 900	21-6 970	22-3 1040	22-11 1110	23-8 1170	24-3 1240	24-10 1300	25-5 1360	26-0 1420	26-6 1480	27-1 1540	27-6 1600	28-0 1650	28-11 1760

Note: The required extreme fiber stress in bending, "F_b", in pounds per sq. inch is shown below each span.

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TABLE 3406-3
ALLOWABLE SPANS FOR "CATHEDRAL" ROOF RAFTERS
(No attic space)

DESIGN CRITERIA:

Deflection - for 30 lbs./sq.ft. live load. Limited to span in inches divided by 240.

Strength - Live load of 30 lbs./sq. ft. plus dead load of 15 lbs./sq. ft. determines required fiber stress.

Joist		Allowable Extreme Fiber Stress in Bending, "F _b " (psi)								
Size (in)	Spacing (in)	500	600	700	800	900	1000	1100	1200	1300
2x6	12.0	7-6 0.27	8-2 0.36	8-10 0.45	9-6 0.55	10-0 0.65	10-7 0.77	11-1 0.89	11-7 1.01	12-1 1.14
	13.7	7-0 0.25	7-8 0.33	8-3 0.42	8-10 0.52	9-5 0.61	9-11 0.72	10-5 0.83	10-10 0.95	11-3 1.07
	16.0	6-6 0.24	7-1 0.31	7-8 0.39	8-2 0.48	8-8 0.57	9-2 0.67	9-7 0.77	10-0 0.88	10-5 0.99
	19.2	5-11 0.22	6-6 0.28	7-0 0.36	7-6 0.44	7-11 0.52	8-4 0.61	8-9 0.70	9-2 0.80	9-6 0.90
	24.0	5-4 0.19	5-10 0.25	6-3 0.32	6-8 0.39	7-1 0.46	7-6 0.54	7-10 0.63	8-2 0.72	8-6 0.81
2x8	12.0	9-10 0.27	10-10 0.36	11-8 0.45	12-6 0.55	13-3 0.66	13-11 0.77	14-8 0.89	15-3 1.01	15-11 1.14
	13.7	9-3 0.25	10-1 0.33	10-11 0.42	11-8 0.52	12-5 0.61	13-1 0.72	13-8 0.83	14-4 0.95	14-11 1.07
	16.0	8-7 0.24	9-4 0.31	10-1 0.39	10-10 0.48	11-6 0.57	12-1 0.67	12-8 0.77	13-3 0.88	13-9 0.99
	19.2	7-10 0.22	8-7 0.28	9-3 0.36	9-10 0.44	10-6 0.52	11-0 0.61	11-7 0.70	12-1 0.80	12-7 0.90
	24.8	7-0 0.19	7-8 0.25	8-3 0.32	8-10 0.39	9-4 0.46	9-10 0.54	10-4 0.63	10-10 0.72	11-3 0.81
2x10	12.0	12-7 0.27	13-9 0.36	14-11 0.45	15-11 0.55	16-11 0.66	17-10 0.77	18-8 0.89	19-6 1.01	20-4 1.14
	13.7	11-9 0.25	12-11 0.33	13-11 0.42	14-11 0.52	15-10 0.61	16-8 0.72	17-6 0.83	18-3 0.95	19-0 1.07
	16.0	10-11 0.24	11-11 0.31	12-11 0.39	13-9 0.48	14-8 0.57	15-5 0.67	16-2 0.77	16-11 0.88	17-7 0.99
	19.2	9-11 0.22	10-11 0.28	11-9 0.36	12-7 0.44	13-4 0.52	14-1 0.61	14-9 0.70	15-5 0.80	16-1 0.90
	24.0	8-11 0.19	9-9 0.25	10-6 0.32	11-3 0.39	11-11 0.46	12-7 0.54	13-2 0.63	13-9 0.72	14-4 0.81
2x12	12.0	15-4 0.27	16-9 0.36	18-1 0.45	19-4 0.55	20-6 0.66	21-8 0.77	22-8 0.89	23-9 1.01	24-8 1.14
	13.7	14-4 0.25	15-8 0.33	16-11 0.42	18-1 0.52	19-3 0.61	20-3 0.72	21-3 0.83	22-2 0.95	23-1 1.07
	16.0	13-3 0.24	14-6 0.31	15-8 0.39	16-9 0.48	17-9 0.57	18-9 0.67	19-8 0.77	20-5 0.88	21-5 0.99
	19.2	12-1 0.22	13-3 0.26	14-4 0.36	15-4 0.44	16-3 0.52	17-1 0.61	17-11 0.70	18-9 0.80	19-6 0.90
	24.0	10-10 0.19	11-10 0.25	12-10 0.32	13-8 0.39	14-6 0.46	15-4 0.54	16-1 0.63	16-9 0.72	17-5 0.81

Note: The required extreme modulus of elasticity, "E", in 1,000,000 psf is shown below each span.

ONE AND TWO-FAMILY DWELLING

TABLE 3406-3 (continued)
ALLOWABLE SPANS FOR "CATHEDRAL" ROOF RAFTERS

30 lbs/sq. ft. Live Load
(Supporting drywall ceiling)

RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber used.

Rafter		Allowable Extreme Fiber Stress in Bending, "F _b " (psi)					
Size (in)	Spacing (in)	1400	1500	1600	1700	1800	1900
2x6	12.0	12-6 1.28	13-0 1.41	13-5 1.56	13-10 1.71	14-2 1.86	14-7 2.02
	13.7	11-9 1.19	12-2 1.32	12-6 1.46	12-11 1.60	13-3 1.74	13-8 1.89
	16.0	10-10 1.10	11-3 1.22	11-7 1.35	11-11 1.48	12-4 1.61	12-8 1.75
	19.2	9-11 1.01	10-3 1.12	10-7 1.23	10-11 1.35	11-3 1.47	11-6 1.59
	24.0	8-10 0.90	9-2 1.00	9-6 1.10	9-9 1.21	10-0 1.31	10-4 1.43
2x8	12.0	16-6 1.28	17-1 1.41	17-8 1.56	18-2 1.71	18-9 1.86	19-3 2.02
	13.7	15-5 1.19	16-0 1.32	16-6 1.46	17-0 1.60	17-6 1.74	18-0 1.89
	16.0	14-4 1.10	14-10 1.22	15-3 1.35	15-9 1.48	16-3 1.61	16-8 1.75
	19.2	13-1 1.01	13-6 1.12	13-11 1.23	14-5 1.35	14-10 1.47	15-2 1.59
	24.0	11-8 0.90	12-1 1.00	12-6 1.10	12-10 1.21	13-3 1.31	13-7 1.43
2x10	12.0	21-1 1.28	21-10 1.41	22-6 1.56	23-3 1.71	23-11 1.86	24-6 2.02
	13.7	19-8 1.19	20-5 1.32	21-1 1.46	21-9 1.60	22-4 1.74	22-11 1.89
	16.0	18-3 1.10	18-11 1.22	19-6 1.35	20-1 1.48	20-8 1.61	21-3 1.75
	19.2	16-8 1.01	17-3 1.12	17-10 1.23	18-4 1.35	18-11 1.47	19-5 1.59
	24.0	14-11 0.90	15-5 1.00	15-11 1.10	16-5 1.21	16-11 1.31	17-4 1.43
2x12	12.0	25-7 1.28	26-6 1.41	27-5 1.56	28-3 1.71	29-1 1.86	29-10 2.02
	13.7	24-0 1.19	24-10 1.32	25-7 1.46	26-5 1.60	27-2 1.74	27-11 1.89
	16.0	22-2 1.10	23-0 1.22	23-9 1.35	24-5 1.48	25-2 1.61	25-10 1.75
	19.2	20-3 1.01	21-0 1.12	21-8 1.23	22-4 1.35	23-0 1.47	23-7 1.59
	24.0	18-1 0.90	18-9 1.00	19-4 1.10	20-0 1.21	20-6 1.31	21-1 1.43

Note: The required extreme modulus of elasticity, "E", in 1,000,000 psf is shown below each span.

TABLE 3406-4
ALLOWABLE SPANS FOR "CATHEDRAL" ROOF RAFTERS
 (No attic space)

DESIGN CRITERIA:

Deflection - for 30 lbs./sq.ft. live load. Limited to span in inches divided by 240.

Strength - Live load of 30 lbs./sq. ft. plus dead load of 10 lbs./sq. ft. determines required fiber stress.

Joist Size (in) Spacing (in)		Allowable Extreme Fiber Stress in Bending, "F _b " (psi)								
		500	600	700	800	900	1000	1100	1200	1300
2x6	12.0	7-11 0.32	8-8 0.43	9-5 0.54	10-0 0.68	10-8 0.78	11-3 0.92	11-9 1.06	12-4 1.21	12-10 1.36
	13.7	7-5 0.30	8-2 0.40	8-9 0.50	9-5 0.61	10-0 0.73	10-6 0.86	11-0 0.99	11-6 1.13	12-0 1.27
	16.0	6-11 0.28	7-6 0.37	8-2 0.47	8-8 0.57	9-3 0.68	9-9 0.80	10-2 0.92	10-8 1.05	11-1 1.18
	19.2	6-3 0.26	6-11 0.34	7-5 0.43	7-11 0.52	8-5 0.62	8-11 0.73	9-4 0.84	9-9 0.95	10-1 1.08
	24.0	5-7 0.23	6-2 0.30	6-8 0.38	7-1 0.46	7-6 0.55	7-11 0.65	8-4 0.75	8-8 0.85	9-1 0.96
2x8	12.0	10-6 0.32	11-6 0.43	12-5 0.54	13-3 0.66	14-0 0.78	14-10 0.92	15-6 1.06	16-3 1.21	16-10 1.36
	13.7	9-9 0.30	10-9 0.40	11-7 0.50	12-5 0.61	13-2 0.73	13-10 0.86	14-6 0.99	15-2 1.13	15-9 1.27
	16.0	9-1 0.28	9-11 0.37	10-9 0.47	11-6 0.57	12-2 0.68	12-10 0.80	13-5 0.97	14-0 1.05	14-7 1.18
	19.2	8-3 0.26	9-1 0.34	9-9 0.43	10-6 0.52	11-1 0.62	11-8 0.73	12-3 0.84	12-10 0.95	13-4 1.08
	24.8	7-5 0.23	8-1 0.30	8-9 0.38	9-4 0.46	9-11 0.55	10-6 0.65	11-0 0.75	11-6 0.85	11-11 0.96
2x10	12.0	13-4 0.32	14-8 0.43	15-10 0.54	16-11 0.66	17-11 0.78	18-11 0.92	19-10 1.06	20-8 1.21	21-6 1.36
	13.7	12-6 0.30	13-8 0.40	14-9 0.50	15-10 0.61	16-9 0.73	17-8 0.86	18-6 0.99	19-4 1.13	20-2 1.27
	16.0	11-7 0.28	12-8 0.37	13-8 0.47	14-8 0.57	15-6 0.68	16-4 0.80	17-2 0.92	17-11 1.05	18-8 1.18
	19.2	10-7 0.26	11-7 0.34	12-6 0.43	13-4 0.52	14-2 0.62	14-11 0.73	15-8 0.84	16-4 0.95	17-0 1.08
	24.0	9-5 0.23	10-4 0.30	11-2 0.38	11-11 0.46	12-8 0.55	13-4 0.65	14-0 0.75	14-8 0.85	15-3 0.96
2x12	12.0	16-3 0.32	17-9 0.43	19-30 0.54	20-61 0.66	21-9 0.78	23-0 0.92	24-1 1.06	25-2 1.21	26-2 1.36
	13.7	15-2 0.30	16-8 0.40	18-0 0.50	19-3 0.61	20-5 0.73	21-6 0.86	22-6 0.99	23-6 1.13	24-6 1.27
	16.0	14-1 0.28	15-5 0.37	16-8 0.47	17-9 0.57	18-10 0.68	19-11 0.80	20-10 0.92	21-91 1.05	22-8 1.18
	19.2	12-1 0.26	14-1 0.34	15-2 0.43	16-3 0.52	17-3 0.62	18-21 0.73	19-0 0.84	19-11 0.95	20-8 1.08
	24.0	11-6 0.23	12-7 0.30	13-7 0.38	14-81 0.48	15-5 0.55	16-3 0.65	17-0 0.75	17-9 0.85	18-6 0.96

Note: The required extreme modulus of elasticity, "E", in 1,000,000 psf is shown below each span.

TABLE 3406-4 (continued)
ALLOWABLE SPANS FOR "CATHEDRAL" ROOF RAFTERS
 30 lbs/sq. ft. Live Load
 (No finished ceiling)

RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top column row) and modulus of elasticity (lower figure in each square) of lumber to be used.

Joist Size (in)		Allowable Extreme Fiber Stress in Bending, "F _b " (psi)					
Spacing (in)		1400	1500	1600	1700	1800	1900
2x6	12.0	13-3 1.52	13-9 1.69	14-2 1.86	14-8 2.04	15-1 2.22	15-6 2.41
	13.7	12-5 1.42	12-10 1.58	13-3 1.74	13-8 1.90	14-1 2.08	14-6 2.25
	16.0	11-6 1.32	11-11 1.46	12-4 1.61	12-8 1.76	13-1 1.92	13-5 2.08
	19.2	10-6 1.20	10-10 1.33	11-3 1.47	11-7 1.61	11-11 1.75	12-3 1.90
	24.0	9-5 1.08	9-9 1.19	10-0 1.31	10-4 1.44	10-8 1.57	10-11 1.70
2x8	12.0	17-6 1.52	18-2 1.69	18-9 1.86	19-4 2.04	19-10 2.22	20-5 2.41
	13.7	16-5 1.42	16-11 1.58	17-6 1.74	18-1 1.90	18-7 2.08	19-1 2.25
	16.0	15-2 1.32	15-8 1.46	16-3 1.61	16-9 1.76	17-2 1.92	17-8 2.08
	19.2	13-10 1.20	14-4 1.33	14-10 1.47	15-3 1.61	15-8 1.75	16-2 1.90
	24.8	12-5 1.08	12-10 1.19	13-3 1.31	13-8 1.44	14-0 1.57	14-5 1.70
2x10	12.0	22-4 1.52	23-2 1.69	23-11 1.85	24-7 2.04	25-4 2.22	26-0 2.41
	13.7	20-11 1.42	21-8 1.58	22-4 1.74	23-0 1.90	23-8 2.08	24-4 2.25
	16.0	19-4 1.32	20-0 1.46	20-8 1.61	21-4 1.76	21-11 1.92	22-6 2.08
	19.2	17-8 1.20	18-3 1.33	18-11 1.47	19-6 1.61	20-0 1.75	20-7 1.90
	24.0	15-10 1.08	16-4 1.19	16-11 1.31	17-5 1.44	17-11 1.57	18-5 1.70
2x12	12.0	27-2 1.52	28-2 1.69	29-1 1.86	29-11 2.04	30-10 2.22	31-8 2.41
	13.7	25-5 1.47	26-4 1.58	27-2 1.74	28-0 1.90	28-10 2.08	29-7 2.25
	16.0	23-6 1.32	24-4 1.46	25-2 1.61	25-11 1.76	26-8 1.92	27-5 2.08
	19.2	21-6 1.20	22-3 1.33	23-0 1.47	23-8 1.61	24-4 1.75	25-0 1.90
	24.0	10-3 1.08	19-11 1.19	20-6 1.31	21-2 1.44	21-8 1.57	22-5 1.70

Note: The required extreme modulus of elasticity, "E", in 1,000,000 psf is shown below each span.

TABLE 3406-5
ALLOWABLE SPANS FOR ROOF RAFTERS
 Over Attic Space
 30 lbs per sq. ft. Live Load
 (Tile, Slate, Concrete Roof Covering)

DESIGN CRITERIA:

Deflection - for 30 lbs./sq.ft. live load. Limited to span in inches divided by 180.

Strength - Live load of 30 lbs./sq. ft. plus dead load of 15 lbs./sq. ft. determines required fiber stress.

RAFTER Size (in)	Spacing (in)	Allowable Extreme Fiber Stress in Bending, "F _b " (psi)								
		500	600	700	800	900	1000	1100	1200	1300
2x4	12.0	4-9 0.20	5-3 0.27	5-8 0.34	6-0 0.41	6-5 0.40	6-9 0.58	7-1 0.67	7-5 0.76	7-8 0.86
	13.7	4-5 0.19	4-11 0.25	5-3 0.32	5-8 0.39	6-0 0.46	6-4 0.54	5-7 0.62	6-11 0.71	7-2 0.80
	16.0	4-1 0.18	4-6 0.23	4-11 0.29	5-3 0.36	5-6 0.43	5-10 0.50	6-1 0.58	6-5 0.66	6-8 0.74
	19.2	3-9 0.16	4-1 0.21	4-5 0.27	4-9 0.33	5-1 0.39	5-4 0.48	5-7 0.53	5-10 0.60	6-1 0.68
	24.0	3-4 0.14	3-8 0.19	4-0 0.24	4-3 0.29	4-6 0.35	4-9 0.41	5-0 0.47	5-3 0.54	5-5 0.61
2x6	12.0	7-6 0.20	8-2 0.27	8-10 0.34	9-6 0.41	10-0 0.48	10-7 0.58	11-1 0.67	11-7 0.76	12-1 0.86
	13.7	7-0 0.19	7-8 0.25	8-3 0.32	8-10 0.39	9-5 0.46	9-11 0.54	10-5 0.62	10-10 0.71	11-3 0.80
	16.0	6-6 0.18	7-1 0.23	7-8 0.29	8-2 0.36	8-8 0.43	9-2 0.50	9-7 0.58	10-0 0.66	10-5 0.74
	19.2	5-11 0.16	6-6 0.27	7-0 0.27	7-6 0.33	7-11 0.39	8-4 0.46	8-9 0.53	9-2 0.60	9-6 0.68
	24.8	5-4 0.14	5-10 0.19	6-3 0.24	6-8 0.29	7-1 0.35	7-6 0.41	7-10 0.47	8-2 0.54	8-6 0.61
2x8	12.0	9-10 0.20	10-10 0.27	11-8 0.34	12-6 0.41	13-3 0.49	13-11 0.58	14-8 0.67	15-3 0.76	15-11 0.86
	13.7	9-3 0.19	10-1 0.25	10-11 0.32	11-8 0.39	12-5 0.46	13-1 0.54	13-8 0.62	14-4 0.71	14-11 0.80
	16.0	8-7 0.18	9-4 0.23	10-1 0.29	10-10 0.36	11-6 0.43	12-1 0.50	12-8 0.58	13-3 0.66	13-9 0.74
	19.2	7-10 0.16	8-7 0.21	9-3 0.27	9-10 0.33	10-6 0.39	11-0 0.46	11-7 0.53	12-1 0.60	12-7 0.68
	24.0	7-0 0.14	7-8 0.19	8-3 0.24	8-10 0.29	9-4 0.35	9-10 0.41	10-4 0.47	10-10 0.54	11-3 0.61
2x10	12.0	12-7 0.20	13-9 0.27	14-11 0.34	15-11 0.41	16-11 0.49	17-18 0.58	18-8 0.67	19-6 0.76	20-4 0.86
	13.7	11-9 0.19	12-11 0.25	13-11 0.32	14-11 0.39	15-10 0.46	16-8 0.54	17-6 0.62	18-3 0.71	19-0 0.80
	16.0	10-11 0.18	11-11 0.23	12-11 0.29	13-9 0.36	14-8 0.43	15-5 0.50	16-2 0.58	16-11 0.66	17-7 0.74
	19.2	9-11 0.16	10-11 0.21	11-9 0.27	12-7 0.33	13-4 0.39	14-1 0.46	14-9 0.53	15-5 0.60	16-1 0.68
	24.0	8-11 0.14	9-9 0.19	10-6 0.24	11-3 0.29	11-11 0.35	12-7 0.41	13-2 0.47	13-9 0.54	14-4 0.61

Note: The required extreme modulus of elasticity, "E", in 1,000,000 psf is shown below each span.

TABLE 3406-5 (continued)
ALLOWABLE SPANS FOR ROOF RAFTERS

RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top column) row) and modulus of elasticity (lower figure in each square) of lumber to be used.

Joist Size Spacing (in) (in)		Allowable Extreme Fiber Stress in Bending, "F _b " (psi)					
		1400	1500	1600	1700	1800	1900
2x4	12.0	8-0 0.96	8-3 1.06	8-6 1.17	8-9 1.28	9-0 1.39	9-3 1.51
	13.7	7-5.8 0.89	7-9 0.99	8-0 1.09	8-3 1.20	8-5 1.30	8-8 1.41
	16.0	6-11 0.83	7-2 0.92	7-5 1.01	7-7 1.11	7-10 1.21	8-0 1.31
	19.2	6-4 0.76	6-6 0.84	6-9 0.92	6-11 1.01	7-2 1.10	7-4 1.20
	24.0	5-8 0.68	5-10 0.75	6-0 0.83	6-3 0.90	6-5 0.99	6-7 1.07
2x6	12.0	12-6 0.96	13-0 1.06	13-5 1.17	13-10 1.28	14-2 1.39	14-7 1.51
	13.7	11-9 0.89	12-2 0.99	12-6 1.09	12-11 1.20	13-3 1.30	13-8 1.41
	16.0	10-10 0.83	11-3 0.92	11-7 1.01	11-11 1.11	12-4 1.21	12-8 1.31
	19.2	9-11 0.76	10-3 0.84	10-7 0.92	10-11 1.01	11-3 1.10	11-6 1.20
	24.8	8-10 0.68	9-2 0.75	9-6 0.83	9-9 0.90	10-0 0.99	10-4 1.07
2x8	12.0	16-6 0.96	17-1 1.06	17-8 1.17	18-2 1.28	18-9 1.39	19-3 1.51
	13.7	15-5 0.89	16-0 0.99	16-6 1.09	17-0 1.20	17-6 1.30	18-0 1.41
	16.0	14-4 0.83	14-10 0.92	15-3 1.01	15-9 1.11	16-3 1.21	16-8 1.31
	19.2	13-1 0.76	13-6 0.84	13-11 0.92	14-5 1.01	14-10 1.10	15-2 1.20
	24.0	11-8 0.68	12-1 0.75	12-6 0.83	12-10 0.90	13-3 0.99	13-7 1.07
2x10	12.0	21-1 0.96	21-0 1.05	22-6 1.17	23-3 1.28	23-11 1.39	24-6 1.51
	13.7	19-8 0.89	20-5 0.99	21-1 1.09	21-9 1.20	22-4 1.30	22-11 1.41
	16.0	18-3 0.83	18-11 0.92	19-6 1.10	20-1 1.11	20-8 1.21	21-3 1.31
	19.2	16-8 0.76	17-3 0.84	17-10 0.92	18-4 1.01	18-11 1.10	19-5 1.20
	24.0	14-11 0.68	15-5 0.75	15-11 0.83	16-5 0.90	16-11 0.99	17-4 1.07

Note: The required extreme modulus of elasticity, "E", in 1,000,000 psf is shown below each span.

THE MASSACHUSETTS STATE BUILDING CODE

TABLE 3406-6
ALLOWABLE SPANS FOR ROOF RAFTERS
 Over Attic Space
 30 lbs. per sq. ft. Live Load
 (Light Roof Coverings - Wood, Asphalt, etc.)

DESIGN CRITERIA:

Deflection - for 30 lbs./sq.ft. live load. Limited to span in inches divided by 180.

Strength - Live load of 30 lbs./sq. ft. plus dead load of 7 lbs./sq. ft. determines required fiber stress.

Joist Size (in)		Allowable Extreme Fiber Stress in Bending, "F _b " (psi)								
Spacing (in)		500	600	700	800	900	1000	1100	1200	1300
2x4	12.0	5-3 0.27	5-9 0.36	6-3 0.45	6-8 0.55	7-1 0.66	7-5 0.77	7-9 0.89	8-2 1.02	8-6 1.15
	13.7	4-11 0.26	5-5 0.34	5-10 0.42	6-3 0.52	6-7 0.62	6-11 0.72	7-3 0.84	7-7 0.95	7-11 1.07
	16.0	4-7 0.24	5-0 0.31	5-5 0.39	5-9 0.48	6-1 0.57	6-5 0.67	6-9 0.77	7-1 0.88	7-4 0.99
	19.2	4-2 0.22	4-7 0.28	4-11 0.35	5-3 0.44	5-7 0.52	5-10 0.61	6-2 0.71	6-5 0.80	6-8 0.91
	24.0	3-9 0.19	4-1 0.25	4-5 0.32	4-8 0.39	5-0 0.47	5-3 0.55	5-6 0.63	5-9 0.72	6-0 0.81
2x6	12.0	8-3 0.27	9-1 0.36	9-9 0.45	10-5 0.55	11-1 0.66	11-8 0.72	12-3 0.89	12-8 1.02	13-4 1.15
	13.7	7-8 0.26	8-5 0.34	9-3 0.42	9-9 0.52	10-4 0.62	10-11 0.72	11-5 0.84	12-0 0.95	12-5 1.07
	16.0	7-2 0.24	7-10 0.31	8-5 0.39	9-1 0.48	9-7 0.57	10-1 0.67	10-7 0.77	11-1 0.88	11-6 0.99
	19.2	6-6 0.22	7-2 0.28	7-9 0.36	8-3 0.44	8-9 0.52	9-3 0.61	9-8 0.72	10-1 0.80	10-6 0.91
	24.8	5-10 0.19	6-5 0.25	6-11 0.32	7-5 0.39	7-10 0.47	8-3 0.55	8-8 0.63	9-1 0.72	9-5 0.81
2x8	12.0	10-11 0.27	11-11 0.36	12-10 0.45	13-9 0.55	14-7 0.66	15-5 0.77	16-2 0.89	16-10 1.02	17-7 1.15
	13.7	10-2 0.26	11-2 0.34	12-1 0.42	12-10 0.52	13-8 0.62	14-5 0.72	15-1 0.84	15-9 0.95	16-5 1.07
	16.0	9-5 0.24	10-4 0.31	11-2 0.39	11-11 0.48	12-8 0.57	13-4 0.67	14-0 0.77	14-7 0.88	15-2 0.99
	19.2	8-7 0.72	0-5 0.28	10-2 0.36	10-11 0.44	11-6 0.52	12-2 0.61	12-9 0.71	13-4 0.80	13-10 0.91
	24.0	7-8 0.19	8-5 0.25	9-1 0.32	9-9 0.39	10-4 0.47	10-11 0.55	11-5 0.63	11-11 0.72	12-5 0.81
2x10	12.0	13-11 0.27	15-2 0.36	16-5 0.45	17-7 0.55	18-7 0.66	19-8 0.77	20-7 0.89	21-8 1.02	22-5 1.15
	13.7	13-0 0.26	14-3 0.34	15-4 0.42	16-5 0.52	17-5 0.62	18-4 0.72	19-3 0.84	20-1 0.95	20-11 1.07
	16.0	12-0 0.26	13-2 0.34	14-3 0.43	15-2 0.53	16-2 0.63	17-0 0.74	17-10 0.85	18-7 0.97	19-5 1.09
	19.2	11-0 0.22	12-0 0.28	13-0 0.36	13-11 0.44	14-9 0.52	15-6 0.61	16-3 0.71	17-0 0.80	17-8 0.91
	24.0	9-10 0.19	10-9 0.25	11-7 0.32	12-5 0.39	13-2 0.47	13-11 0.55	14-7 0.63	15-2 0.72	15-10 0.81

Note: The required extreme modulus of elasticity, "E", in 1,000,000 psf is shown below each span.

TABLE 3406-6 (continued)
ALLOWABLE SPANS FOR ROOF RAFTERS
 Over Attic Space

RAFTERS: Spans are measured along the horizontal projection row and loads are considered as applied on the horizontal projection.

HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top column) and modulus of elasticity (lower figure in each square) of lumber to be used.

Joist Size (in) Spacing (in)		Allowable Extreme Fiber Stress in Bending, "F _b " (psi)					
		1400	1500	1600	1700	1800	1900
2x4	12.0	8-9 1.28	9-1 1.42	9-5 1.57	9-8 1.72	10-0 1.87	10-3 2.03
	13.7	8-3 1.20	8-6 1.33	8-9 1.47	9-1 1.61	9-4 1.75	9-7 1.90
	16.0	7-7 1.11	7-11 1.23	8-2 1.36	8-5 1.49	8-8 1.62	8-10 1.76
	19.2	6-11 1.01	7-2 1.12	7-51 1.24	7-8 1.36	7-11 1.48	8-1 1.60
	24.0	6-3 0.91	6-5 1.01	6-8 1.11	6-10 1.21	7-1 1.32	7-3 1.43
2x6	12.0	13-10 1.28	14-4 1.42	14-9 1.57	15-3 1.72	15-8 1.87	16-1 2.03
	13.7	12-11 1.20	13-4 1.33	13-10 1.47	14-3 1.61	14-8 1.75	15-1 1.90
	16.0	12-0 1.11	12-5 1.23	12-9 1.36	13-2 1.49	13-7 1.62	13-11 1.76
	19.2	10-11 1.01	11-4 1.12	11-8 1.24	12-0 1.36	12-5 1.48	12-9 1.60
	24.8	9-9 0.81	10-1 1.01	10-5 1.11	10-9 1.21	11-1 1.32	11-5 1.43
2x8	12.0	18-2 1.28	18-10 1.42	19-6 1.57	20-1 1.72	20-8 1.87	21-3 2.03
	13.7	17-0 1.20	17-8 1.33	18-2 1.47	18-9 1.61	19-4 1.75	19-10 1.90
	16.0	15-9 1.11	16-4 1.23	16-10 1.36	17-4 1.49	17-11 1.62	18-4 1.76
	19.2	14-5 1.01	14-11 1.12	15-5 1.24	15-10 1.36	16-4 1.48	16-9 1.60
	24.0	12-10 0.91	13-4 1.01	13-9 1.11	14-2 1.21	14-7 1.32	15-0 1.43
2x10	12.0	23-3 1.28	24-1 1.42	24-10 1.57	25-7 1.72	26-4 1.87	27-1 2.03
	13.7	21-9 1.20	22-6 1.33	23-3 1.47	23-11 1.61	24-8 1.75	25-4 1.90
	16.0	20-1 1.22	20-10 1.35	21-6 1.49	22-2 1.63	22-10 1.78	23-5 1.93
	19.2	18-4 1.01	19-0 1.12	19-8 1.24	20-3 1.36	20-10 1.48	21-5 1.60
	24.0	16-5 0.91	17-0 1.01	17-7 1.11	18-1 1.21	18-7 1.32	19-2 1.43

Note: The required extreme modulus of elasticity, "E", in 1,000,000 psf is shown below each span.

SECTION 3407.0 ROOF COVERINGS

3407.1 General: Conformity with applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

3407.1.1 Coverings: Roofs shall be covered with Class A, B, or C roof covering.

Exception: The roof coverings set forth in Sections 3407.3, 3407.8, 3407.9 and 3407.10 may be used provided the building is located in areas designated by law as permitting their use and not less than ten (10) feet are provided between buildings.

3407.1.2 Class A materials: The roofing materials set forth in Sections 3407.4, 3407.5, 3407.6 and 3407.7 and concrete slabs may be accepted as Class A roof covering.

3407.1.3 Other roof systems: Material used as part of an integral roof solar collector system shall be acceptable so long as it is properly flashed and caulked with silicone or similar sealant to be waterproofed and provided it is used in combination with a metal absorber plate beneath the surface. (See 3407.11.)

3407.2 Base sheet application: Base sheets shall be applied only to solid surface roofs and shall be cemented to a suitable deck using not less than twenty-five (25) pounds of hot asphalt or not less than two (2) gallons of cold bituminous compound in accordance with the manufacturer's published specifications or thirty (30) pounds of hot coal tar pitch per roofing square, or nailed to a roof sheathing using not less than one (1) nail to each one and one-third (1-1/3) square feet, or may be spot-cemented to a non-nailable deck using not less than ten (10) pounds of hot asphalt per roofing square.

3407.2.1 Cementing: Successive layers shall be cemented to the base sheets using no less cementing material than that specified for solidly cemented base sheets.

3407.3 Composition asphalt organic felt shingles

3407.3.1 General: Composition shingles shall be applied only to solidly sheathed roofs.

3407.3.2 Slope criteria: Composition shingles shall not be installed on a roof having a slope of less than four (4) in twelve (12) unless approved by the building official.

3407.3.3 Other requirements: Composition shingles shall be fastened according to manufacturer's printed instructions.

3407.3.4 Flashing: Roof valley flashing shall be provided of not less than No. 28 galvanized sheet gauge corrosion-resistant metal and shall extend at least eight (8) inches from the center line each way, and shall have a splash diverter rib not less than three-quarter (3/4) inch high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four (4) inches.

3407.3.5 Other material: Roof valley flashing may be of laced composition shingles, applied in an approved manner, with an underlay of not less than thirty (30) pound felt extending ten (10) inches from the center line each way, or shall be of two (2) layers of ninety (90) pound mineral surfaced cap sheet cemented together with the bottom layer not less than twelve (12) inches wide laid face down, and the top layer not less than twenty-four (24) inches wide laid face up.

3407.4 Slate shingles

3407.4.1 General: Slate shingles shall be applied in an approved manner and securely fastened with corrosion-resistant nails or corrosion-resistant nails and wire.

3407.4.2 Underlay: Slate shingle roofs shall have an underlay of not less than two (2) layers of fifteen (15) pound felt or one (1) layer of thirty (30) pound felt, applied as required for a base sheet.

3407.4.3 Installation: Roof valley flashing shall be provided of not less than No. 28 gauge galvanized sheet corrosion-resistant metal and shall extend at least eleven (11) inches from the center line each way and shall have a splash diverter rib not less than one (1) inch high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four (4) inches.

3407.5 Asbestos cement shingles

3407.5.1 General: Asbestos-cement roofing shall be applied in an approved manner. Asbestos-cement roofing shall have an underlay of not less than fifteen (15) pound felt, applied as required for a base sheet. The underlay may be omitted where the asbestos-cement shingles or sheets are applied over an existing roof covering.

3407.5.2 Slope criteria: Asbestos-cement roofing shall not be installed on a roof having a slope of less than three (3) in twelve (12) unless approved by the building official.

3407.5.3 Thickness: Corrugated asbestos-cement roofing not less than five-sixteenths (5/16) inch thick may be used wherever No. 24 galvanized sheet gauge corrugated steel is permitted.

3407.5.4 Installation: Roof valley flashing shall be the same as required for slate shingles. See Section 3407.3.3.

3407.6 Metal

3407.6.1 General: Flat sheets or shingles shall be applied only to solidly sheathed roofs.

3407.6.2 Application: Metal roofing shall be applied in an approved manner, consistent with manufacturer's recommendations.

3407.6.3 Slope criteria: Metal shingles shall not be installed on a roof having a slope of less than three (3) in twelve (12) unless approved by the building official.

3407.6.4 Installation: Metal shingles shall be applied over an underlay of not less than thirty (30) pound felt, applied as required for a base sheet.

3407.7 Tile, clay or concrete shingles

3407.7.1 General: All roof tile shall be securely fastened with corrosion-resistant nails or nails and wire, or other approved means.

3407.7.2 Slope criteria: Tile shall be installed on a roof having a slope of less than three (3) in twelve (12) unless approved by the building official.

3407.7.3 Anchor lugs: Tile with projection anchor lugs at the bottom of the tile shall be held in position by means of one (1) inch by two (2) inch wood stripping, treated to resist moisture deterioration, nailed to the roof sheathing over the underlay, or other approved means.

3407.7.4 Underlay: Tile roofs shall have an underlay of not less than two (2) layers of fifteen (15) pound felt or one (1) layer of thirty (30) pound felt, applied as required for a base sheet.

3407.7.5 Valley flashing: Valley flashing shall be the same as required for slate shingles.

3407.8 Built-up roofing

3407.8.1 General: Mineral aggregate surfaced built-up roofing shall consist of three (3) layers of fifteen (15) pound fiber felt installed in accordance with this section on roofs having slopes not greater than three (3) in twelve (12).

3407.8.2 Roof surface: Built-up roofing shall be applied only to solid surface roofs.

3407.8.3 Base sheets: Base sheets shall be cemented to a suitable deck using not less than twenty-five (25) pounds of hot asphalt or not less than two (2) gallons of cold bituminous compound in accordance with manufacturer's published specifications or thirty (30) pounds of hot coal tar pitch per roofing square, or nailed to roof sheathing using not less than one (1) nail to each one and one-third (1-1/3) square feet, or may be spot-cemented to a non-nailable deck using not less than ten (10) pounds of hot asphalt per roofing square.

3407.8.4 Successive layering: Successive layers shall be cemented to the base sheets using no less cementing material than that specified for solidly cemented base sheets.

3407.8.5 Aggregate surfaced roofs: Mineral aggregate surfaced roofs shall be surfaced with not less than fifty (50) pounds of hot asphalt or other cementing material in which is embedded not less than three hundred (300) pounds of gravel or other approved surfacing materials or two hundred fifty (250) pounds of crushed slag per roofing square.

3407.8.6 Cap sheets: Cap sheets shall be cemented to the base sheets using no less cementing material than that specified for solidly cemented base sheets.

3407.8.7 Application temperatures: Hot asphalt shall be applied at a temperature of not less than 375° F. nor more than 450° F. for high melt types. Low melt types shall not be applied at a temperature of less than 350° F. nor more than 400° F. Coal tar pitch shall not be heated to a temperature above 375° F.

3407.9 Wood shingles

3407.9.1 General: Wood shingles may be applied to roofs with solid or spaced sheathing. The spaced sheathing shall be spaced not to exceed four (4) inches clear nor more than the width of the sheathing board. Spaced sheathing shall be not less than one (1) inch by three (3) inches nominal dimensions.

3407.9.2 Application: Shingles shall be laid with a side lap of not less than one and one-half (1-1/2) inches between joints in adjacent courses, and one-half (1/2) inch in alternate courses. Spaces between shingles shall be not less than one-quarter (1/4) inch nor more than three-eighths (3/8) inch. Each wood shingle shall be fastened to the sheathing with two (2) nails only.

3407.9.3 Slope criteria: Shingles shall not be installed on a roof having a slope less than four (4) in twelve (12) unless they are installed over an underlay of not less than fifteen (15) pound felt, applied as required for a base sheet.

3407.9.4 Valley flashing: Roof valley flashing shall be provided of not less than No. 28 gauge galvanized sheet corrosion-resistant metal and shall extend eight (8) inches from the center line each way. Sections of flashing shall have an end lap of not less than four (4) inches.

3407.9.5 Weathering: Weather exposures shall not exceed those set forth in Reference Standard RS-21-9. Hip and ridge weather exposures shall not exceed those permitted for the field of the roof.

3407.10 Wood shakes

3407.10.1 General: Wood shakes may be applied to roofs with solid or spaced sheathing. The spaced sheathing shall be spaced not to exceed four (4) inches clear nor more than the width of the sheathing board.

Spaced sheathing shall be not less than one (1) inch by four (4) inches nominal size. In snow areas, sheathing shall be solid and the shakes shall be applied over an underlay of not less than fifteen (15) pound felt, applied as required for a base sheet.

3407.10.2 Spacing: Shakes may be laid in straight or staggered courses with a side lap of not less than one and one-half (1-1/2) inches between joints in adjacent courses. Spacing between shakes shall be not more than one-half (1/2) inch.

3407.10.3 Fastening: Each wood shake shall be fastened to the sheathing with two (2) nails. The starter course at the eaves shall be doubled and the bottom layer shall be either fifteen (15) or eighteen (18) inch wood shakes or wood shingles. Fifteen (15) inch or eighteen (18) inch shakes may be used for the final course at the ridge.

3407.10.4 Underlay: Shakes shall be laid with not less than eighteen (18) inch wide strips of not less than fifteen (15) pound felt shingled between each course in such manner that no felt is exposed to the weather below the shake butts.



3407.10.5 Slope criteria: Shakes shall not be installed on a roof having a slope less than four (4) in twelve (12) unless they are installed over an underlay of not less than thirty (30) pound felt, applied as required for a base sheet.

3407.10.6 Valley flashing: Roof valley flashing shall be provided of not less than No. 28 gauge galvanized sheet corrosion-resistant metal and shall extend at least eleven (11) inches from the center line each way and shall have a splash diverter rib not less than one (1) inch high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four (4) inches.

3407.10.7 Weathering: Weather exposures shall not exceed those set forth in Reference Standard RS-21-9. Hip and ridge weather exposures shall not exceed those permitted for the field of the roof.

3407.11 Solar collectors: All solar collectors attached to but mounted above a finished roof shall be firmly anchored to the roof structure or solid blocking connecting structural elements and all the roof penetrations sealed to prevent water leakage. All solar collectors integral with the roof shall be designed for roof loads specified in Section 710.0, sealed to prevent water leakage and have an approved cover plate. Refer to allowable spans for roof rafters supporting solar collectors as contained in table 3407-11.

TABLE 3407-11
ALLOWABLE SPANS FOR ROOF RAFTERS
SUPPORTING SOLAR COLLECTORS

								
	CONDITION A				CONDITION B			
Member	800 psi (spruce or better) MAX SPAN		1200 psi (hemfir or better) MAX SPAN		800psi (spruce or better) MAX SPAN		1299 psi (hemfir or better) MAX SPAN	
	LRC	HRC	LRC	HRC	LRC	HRC	LRC	HRC
2 x 6								
12" o.c.	9-1	8-8	11-3	10-8	7-0	6-9	8-10	8-6
16" o.c.	7-11	7-5	9-9	9-3	6-0	5-10	7-6	7-3
24" o.c.	6-8	6-0	7-11	7-5	4-10	4-9	6-0	5-10
2 x 8								
12" o.c.	12-2	11-7	15-1	14-4	9-7	9-3	12-0	11-7
16" o.c.	10-6	10-0	13-0	12-4	8-2	7-11	10-3	9-11
24" o.c.	8-6	8-1	10-6	10-0	6-5	6-3	8-2	7-11
2 x 10								
12" o.c.	15-9	14-11	19-6	18-5	12-7	12-1	15-9	15-2
16" o.c.	13-6	12-10	16-9	15-10	10-9	10-4	13-5	12-11
24" o.c.	10-11	10-5	13-6	12-10	8-6	8-3	10-8	10-4
2 x 12								
12" o.c.	19-4	18-4	23-11	22-7	15-8	15-0	19-7	18-10
16" o.c.	16-8	15-9	20-6	19-5	13-4	12-10	16-9	16-1
24" o.c.	13-5	12-9	16-7	15-9	10-8	10-3	13-4	12-10

See Following page for instructions in using this table and table notes.

TABLE 3407-11 (continued)
ALLOWABLE SPANS FOR ROOF RAFTERS
SUPPORTING SOLAR COLLECTORS

HOW TO USE TABLE 3407-11:

1. Check to determine that none of the maximum conditions listed below are exceeded (see Notes)
 - a. maximum pitch of collectors - 20:12 (60°)
 - b. maximum collector weight - 7 lbs. per sq. ft.
 - c. maximum length of collector - 9 ft.
2. Determine whether Condition A or Condition B applies
3. Inspect roof rafters and determine their size, spacing & type of wood. (Most are hemfir or better)
4. Determine whether light roof construction (LRC-asphalt, wood shingles, etc.) or heavy roof construction (HRC-slate, tile shingles, etc.) applies.
5. Read allowable span from tables. Rafter spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

Notes to Table 3407-11:

Provide solid blocking between each panel connection to roof. Lag bolt or through bolt panel connection to rafters or blocking.

For situations exceeding any maximum condition listed above or not shown in Condition A or B, the structure shall be approved by a licensed professional engineer or registered architect

DESIGN CRITERIA: (Table 3407-11)

Strength: 10 lbs per sq. ft. (Light roof construction-LRC) or 15 lbs. per sq. ft. (heavy roof construction-HRC) as noted plus 30 lbs. per sq. ft. live load plus load of drifting snow plus loads of solar collectors determine fiber stress.

Deflection: For 30 lbs. per sq. ft. live load, limited to span in inches divided by 180.

**SECTION 3408.0 CHIMNEYS, FIREPLACES
AND CONNECTOR PIPES**

3408.1 Types of chimneys

3408.1.1 Factory-built chimneys: Factory-built chimneys are factory-made chimneys tested to U.L. 103 and shall be installed in strict accordance with the terms of their approval and listing and the manufacturer's instructions.

3408.1.2 Masonry chimneys: Masonry chimneys shall be field constructed to meet the requirements of Sections 3408.2 and 3408.3.

3408.2 Masonry chimneys, general requirements

3408.2.1 Foundations: Masonry chimneys shall be supported on properly designed foundations of masonry or reinforced concrete or on noncombustible material having a fireresistance rating of not less than three (3) hours, provided such supports are independent of the building construction, and the load is transferred to the ground.

3408.2.2 Structural design: Chimneys shall be designed, anchored, supported and reinforced as required in this article. Chimneys shall not support any structural load other than their own weight unless designed to act as supporting members. Chimneys in wood-frame buildings shall be anchored laterally at the ceiling lines and at each floor line which is more than six (6) feet above grade, except when entirely within the framework of the building.

3408.2.3 Area: Chimney passageways shall not be smaller in area than the vent connection on the appliance attached thereto, nor less than as set forth in Table 3408-2 unless alternate approved engineering methods have been used to design the system.

**TABLE 3408-2
MINIMUM PASSAGE AREAS FOR MASONRY CHIMNEYS**

Type of masonry chimney	Minimum cross-sectional area	
	Round	Square or rectangle
Residential appliances	50 sq. inches	50 sq. inches
Fireplace	1/12 of opening Minimum 50 sq. inches	1/10 of opening Minimum 63 sq. inches
Solid fuel burning appliances	50 sq. inches	57 sq. inches

Note 1. Areas for chimneys shall be determined using accepted engineering methods and as approved by the department.

Note 2. Where fireplaces open on more than one side, the fireplace opening shall be measured along the greatest dimension.

3408.2.4 Corbeling: Masonry chimneys shall not be corbeled from a wall more than six (6) inches nor shall a masonry chimney be corbeled from a wall which is less than twelve (12) inches in thickness, unless it projects equally on each side of the wall. In the second story of a two-story building corbeling of masonry chimneys on the exterior of the enclosing walls may equal the exterior wall thickness. In any case, the corbeling shall not exceed one (1) inch projection for each course of brick.

3408.2.5 Change in size or shape: Changes in the size or shape of a masonry chimney, where the chimney passes through the roof, shall not be permitted within a distance of six (6) inches above or below the roof joists or rafters.

3408.2.6 Inlets: Every connector inlet to any masonry chimney shall enter the side thereof and shall be of metal not less than No. 24 Manufacturer's Standard Gauge (0.024 inch) or five-eighths (5/8) inch thick refractory material (see Section 3408.6 for chimney connectors).

3408.2.7 Cleanouts: Every chimney flue shall be provided with an approved cleanout having a tight-fitting cover. Such cleanouts shall be installed at least twelve (12) inches below the lowest chimney inlet opening.

3408.2.8 Firestopping: All spaces between chimneys and floors and ceilings through which chimneys may pass shall be firestopped with noncombustible material. The firestopping of spaces between chimneys and wood joists, beams or headers shall be to a depth of one (1) inch only placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

3408.2.9 Smoke test: Masonry chimneys shall be proved tight by a smoke test after erection and before being put into use.

3408.3 Masonry chimneys

3408.3.1 Construction: Masonry chimneys shall be constructed of solid masonry units or reinforced concrete with walls not less than four (4) inches thick or rubble stone masonry not less than twelve (12) inches thick. Masonry shall be constructed with full bed and head mortar joints (see Figure 3408.3).

3408.3.2 Lining: Masonry chimneys shall be lined with fire-clay flue lining (ASTM C315), or the equivalent, not less than five-eighths (5/8) of an inch thick, or with liner of other approved material that will resist corrosion, softening or cracking from flue gases at temperatures up to seventeen hundred (1700) degrees F.

3408.3.2.1 Liner installation: Fire-clay flue liner shall be installed ahead of the construction of the chimney as it is carried up and carefully bedded one on the other in refractory mortar (ASTM C105, medium duty), or the equivalent, with close fitting joints left smooth on the inside.

3408.3.2.2 Clearances: Liners shall be separate from the chimney wall by one inch clearance and the space between the liner and masonry shall not be filled; only enough mortar shall be used to make a good joint and hold the liners in position.

3408.3.2.3 Starting point: Flue liners shall start from a point not less than eight (8) inches below the lowest vent connector entrance. The lining shall extend, as nearly vertical as possible, for the entire height of the chimney.

3408.3.2.4 Adjoining flues: Where two (2) adjoining flues in the same chimney are separated only by flue liners, the joints of the adjacent flue liners shall be staggered at least seven (7) inches.

3408.3.2.5 Flue partitions: Where more than two (2) flues are located in the same chimney, masonry wythes (partitions) at least four (4) inches wide and bonded into the masonry walls of the chimney shall be built at such points between adjacent flue linings that there are not more than two (2) flues in any group of adjoining flues without such wythe separation.

3408.3.2.6 Termination (height): Masonry chimneys shall extend at least three (3) feet above the highest point where they pass through the roof of a building and at least two (2) feet higher than any portion of a building within ten (10) feet.

3408.3.2.7 Multiple flue connections: A solid fuel burning heating appliance may be vented into a common flue of a masonry chimney with a liquid fuel burning device provided that:

1. the flue does not also vent a working fireplace;
2. the solid fuel burning appliance's connector, if separate, shall enter at a minimum of six (6) inches below the liquid fueled appliance's connector pipe;
3. all appliances shall be approved by the appropriate state agencies; and
4. the flue shall be of sufficient size to serve all the units connected to it if operated simultaneously (see Table 3408.3.2.7).

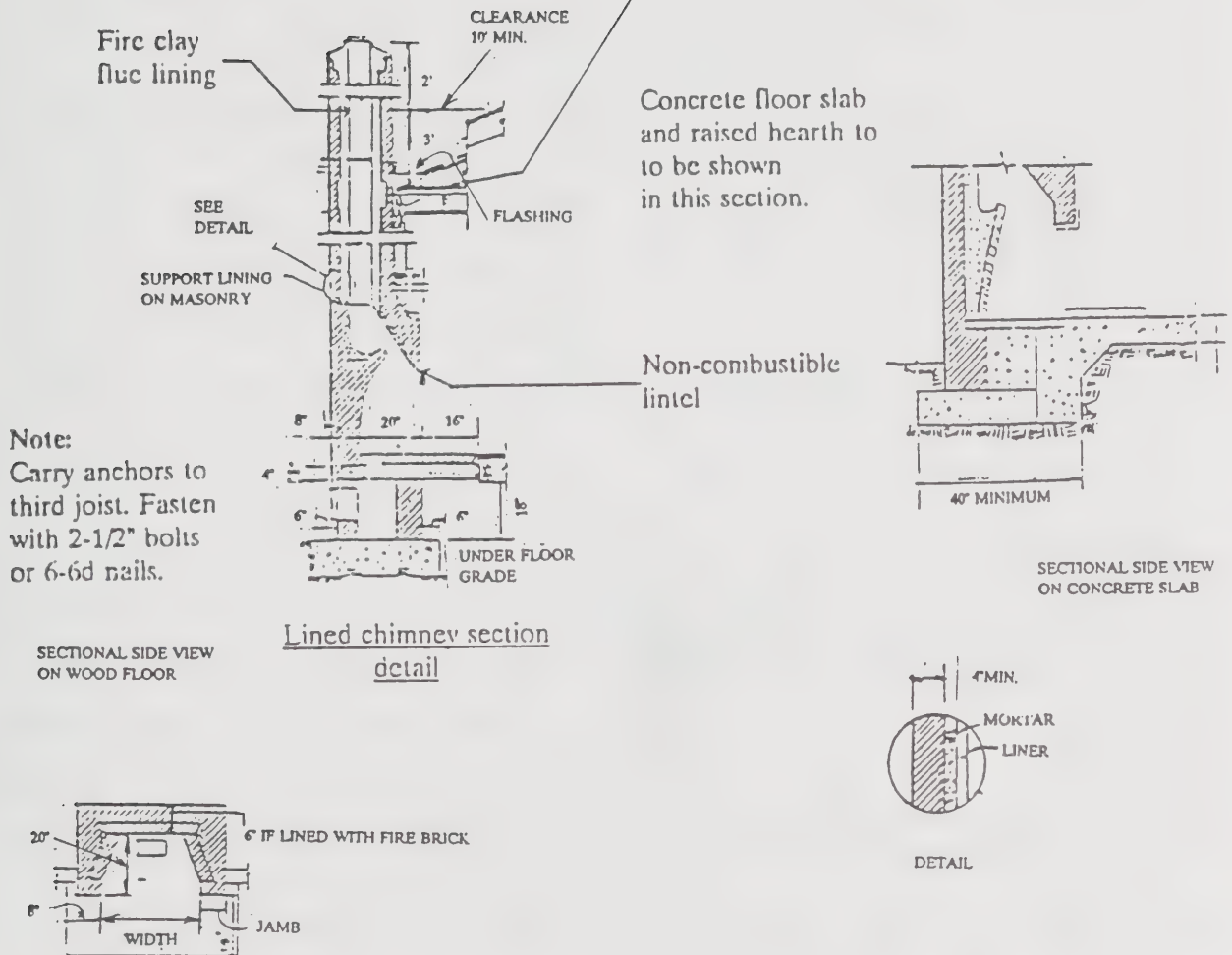
3408.3.3 Clearance from combustible material

3408.3.3.1 General: All wood beams, joists and studs shall be trimmed away from chimneys. Headers, beams, joists and studs shall not be less than two (2) inches from the outside face of a chimney or from masonry enclosing a flue. Ends of wood girders may be supported on a corbeled shelf of a masonry chimney, provided there is not less than eight (8) inches of solid masonry between the ends and the flue liner.

3408.3.3.2 Other material: Combustible lathing, furring or plaster grounds shall not be placed against a chimney at any point more than one and one-half (1-1/2) inches from the corner of the chimney, but this shall not prevent plastering directly on the masonry or on metal lath and metal furring, nor shall it prevent placing chimneys for low-heat appliances entirely on the exterior of a building against the sheathing.

FIGURE 3408-3
FIREPLACE CONSTRUCTION DETAILS

2 3/16" x 1" steel straps cast in chimney and to frame by 2-1/2" bolts or 6-16d nails per strap. Where joints are parallel to chimney straps to be connected to third joist from face of chimney.



Note:
Carry anchors to third joist. Fasten with 2-1/2" bolts or 6-6d nails.

Plan at top of hearth

Notes:

1. Where plates are cut anchor to chimney by 3/16" x 1" steel straps hooked into chimney and attached to plates by 2-3/8"x 3" lag screws, 2-1/2" bolts or 6-16d nails.
 2. Where dampers are used, they shall be not less than No. 12 ga. metal and when "fully open" the damper opening shall be not less than 90% of the required flue area.
- Note: The fireplace ashpit and cleanout shown is optional.

All footings: To extend into natural undisturbed ground below frost line.

TABLE 3408.3.2.7
CAPACITY OF A MASONRY CHIMNEY SERVING TWO APPLIANCES

Total vent height (ft) of not less than	Combined appliance input rating of not greater than (Thousands of BTU's per hour)				
8	81	118	162	277	405
10	89	129	175	300	450
15	105	150	210	360	540
20	120	170	240	415	640
30	135	195	275	490	740
50	-	-	325	600	910
Linear Dimensions with Equivalents					
nominal liner size (in) (sq./rect)	4 x 8	4 x 8	8 x 8	8 x 12	12 x 16
inside dimension of liner	2-1/2 x 6-1/2	2-1/2 x 6-1/2	6-3/4 x 10-1/2	6-1/2 x 10-1/2	9-1/2 x 13-1/2
inside diameter (in) (circular)	6	7	8	10	12
equivalent area	28.3	38.5	50.3	78.5	113.0

3408.4 Factory-built chimneys, general requirements

3408.4.1 Prohibited installation

3408.4.1.1 Single wall: Single wall metal chimneys shall not be used in one- and two-family dwellings; connector pipe may be single wall (refer to 3408.5).

3408.4.2 Clearances: Factory-built exterior and interior chimneys shall have a clearance of not less than two (2") inches from combustible construction, or shall be installed to manufacturers' recommended clearances, whichever are more stringent. Factory-built chimneys shall be tested to U.L. Std. 103.

3408.4.3 Support: Metal chimneys shall be supported on properly designed supports of noncombustible material.

3408.4.4 Cleanouts: Cleanout openings shall be provided at the base of every metal chimney.

3408.5 Termination (height)

3408.5.1 General: All chimneys shall extend at least three (3) feet above the highest point where they pass through the roof of a building and at least two (2) feet higher than any portion of a building within ten (10) feet.

3408.5.2 Outlet: The outlet of a metal chimney equipped with an exhauster may terminate at a location not less than three (3) feet from an adjacent building or building opening and at least ten (10) feet above grade or walkways. In any case, the outlet shall be so arranged that the flue gases are not directed so as to jeopardize people, overheat combustible structures or enter building openings in the vicinity of the outlet.

3408.5.3 Ventilation thimble: Where a non-insulated metal chimney connector passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized iron or approved corrosion-resistant metal, extending not less than nine (9) inches below and nine (9) inches above the roof construction, and of a size to provide not less than six (6) inches clearance on all sides of the chimney, or the combustible material in the roof construction shall be cut away so as to provide not less than eighteen (18) inches clearance on all sides of the chimney with the opening closed up with noncombustible material.

3408.6 Chimney connector pipe

3408.6.1 Materials: Single wall chimney connector pipe shall be constructed of not less than the following gauge galvanized metal specified in Table 3408-6.

**TABLE 3408-6
MINIMUM CHIMNEY CONNECTOR GAUGES**

Diameter of Connector	Thickness (inches)	Birmingham or Stubs Gauge
Less than 6"	0.022 in.	24
6" to less than 10"	0.028 in.	22
10" to 12"	0.034 in.	20
13" to 16"	0.040 in.	18
greater than 16"	0.064 in.	16

Note: The corrosive resistance shall be equivalent to or better than galvanized metal.

3408.6.2 Single wall metal pipe:

1. shall be used only for runs directly from the space in which the appliance is located through the roof or exterior wall to the outer air. A pipe passing through a roof shall extend without interruption through roof flashing, roof jack or roof thimble.
2. shall not originate in any unoccupied attic or concealed space, and shall not pass through any attic, inside wall, concealed space, or through any floor.

3408.6.3 Size: The size of the chimney connector shall be not less than the size of the smoke outlet from the appliance.

3408.6.4 Fastening: Connector sections shall be securely fastened together and into the chimney but in a way that they can be readily disassembled for cleaning.

3408.6.5 Clearances: Single wall chimney connectors shall be installed with the clearances to combustible materials specified in Table 3408.6.2. Reduced clearances shall be used with double wall or insulated connector pipe.

3408.6.6 Slope: Horizontal runs of chimney connectors shall have a continuous rise toward the chimney of not less than one quarter (1/4) inch per foot.

3408.6.7 Offsets: Chimney connectors shall have not more than two (2) offsets.

3408.6.8 Combustible walls: Chimney connectors may pass through combustible walls and partitions when protected by approved thimbles or by providing the required clearances.

3408.7 Fireplaces

3408.7.1 General: Fireplaces, barbecues, smoke chambers and fireplace chimneys shall be of solid masonry or reinforced concrete or other approved materials, and shall conform to requirements of this section.

3408.7.2 Construction: Structural walls of fireplaces shall be at least eight (8) inches thick. Where a lining of low duty refractory brick (ASTM C64) or the equivalent, at least two (2) inches thick laid in fire clay mortar (ASTM C105, medium duty), or the equivalent, or other approved lining is provided, the total thickness of back and sides, including the lining, shall be not less than eight (8) inches. Where such lining is not provided, the thickness of back and sides shall be not less than twelve (12) inches. The firebox shall be twenty (20) inches in depth and will be permitted to be open on all sides, provided all fireplace openings are located entirely within one (1) room. All fireplaces shall have a tight fitting flue damper with a readily accessible control.

Exception: When the functional design of a fireplace requires a firebox depth of less than twenty (20) inches, hearth extensions as outlined in Section 3408.7.7 shall be increased. The combined dimension of firebox and hearth extension shall not be less than thirty-six (36) inches.

**TABLE 3408.6.2
CHIMNEY CONNECTOR PIPE CLEARANCES**

Diameter (inches)	Clearance (inches)	Reduced Clearance
0 -12	18	9
12 - 36	20	10
over 36	36	18

3408.7.3 Lining: The lining shall extend from the throat of the fireplace to a point at least four (4) inches above the top of the enclosing masonry walls.

3408.7.4 Clearance

3408.7.4.1 Distance: The distance between fireplace and combustibles shall be at least four (4) inches, and such combustibles shall not be placed within six (6) inches of the fireplace opening. Wood facings or trim normally placed around the fireplace opening may be permitted when conforming to the requirements of this section; however, such facing or trim shall be furred out from the fireplace wall at least four (4) inches and attached to noncombustible furring strips. The edges of such facings

or trim shall be covered with a noncombustible material. Where the walls of the fireplace are twelve (12) inches thick, the facings or trim may be directly attached to the fireplace.

3408.7.4.2 Metal hoods: Metal hoods used as part of a fireplace or barbecue shall be at least eighteen (18) inches from combustible material unless approved for reduced clearances.

3408.7.4.3 Metal: Metal hoods used as a part of a fireplace or barbecue shall be at least No. 18 B&S (0.0403 inch) Gauge sheet copper, No. 18 Galvanized Steel Gauge (0.052 in.) galvanized steel or other equivalent corrosion-resistant ferrous metal with all seams and connections of smokeproof unsoldered construction. The hoods shall be sloped at an angle of forty-five (45) degrees or less from the vertical and shall extend horizontally at least six (6) inches beyond the limits of the firebox.

3408.7.4.4 Metal heat circulators: Approved metal heat circulators may be installed in fireplaces, provided the thickness of the fireplace walls is not reduced.

3408.7.4.5 Smoke chamber: All walls, including back walls, shall be at least eight (8) inches in thickness.

3408.7.5 Areas of flues, throats and dampers: The net cross-sectional area of the flue and of the throat between the firebox and the smoke chamber of a fireplace shall be at least that required in Table 3408.2.

When dampers are used, damper openings shall be at least, when fully opened, equal to the required flue area and shall be of No. 12 Galvanized Steel Gauge (0.018 in.) metal.

3408.7.6 Lintel: Masonry over the fireplace opening shall be supported by a noncombustible lintel.

3408.7.7 Hearth: Every fireplace shall be constructed with a hearth of brick, stone, tile or other noncombustible material. For fireplaces with an opening of less than six (6) square feet, the hearth shall extend not less than sixteen (16) inches in front and not less than eight (8) inches on each side of the fireplace opening. For fireplaces with an opening of six (6) square feet or more, the hearth shall extend not less than twenty (20) inches in front and not less than twelve (12) inches on each side of the fireplace opening. Such hearths shall be properly supported or reinforced to carry their own weight and all imposed loads. Combustible forms and centers used during the construction of hearth and hearth extension shall be removed after the construction is complete.

3408.7.8 Firestopping: Firestopping between chimneys and wooden construction shall meet the requirements specified in Section 3408.2.8.

3408.7.9 Support: Fireplaces shall be supported on foundations designed in conformity with Section 3408.2.1.

3408.7.10 Screens: Screens or other acceptable protection devices shall be provided for all fireplace openings.

3408.7.11 Imitation fireplaces: Imitation fireplaces shall not be used for the burning of gas, solid or liquid fuel.

3408.7.12 Factory-built fireplaces: A product which is defined as a fire chamber, its chimney, and related parts consisting entirely of factory-made parts designed for unit assembly without requiring field construction and enclosed in a wall, shall be tested by an approved testing agency to Underwriters Laboratories (U.L.) Standard U.L. 127 and installed in accordance with manufacturer's recommendations not in conflict with the basic code.

3408.7.12.1 Hearth extensions: Hearth extensions shall comply with the dimensions of Section 3408.7.7 but may be placed on combustible subflooring or finish flooring and shall be readily distinguished from the surrounding floor.

3408.7.12.2 Air duct construction: An air duct system portion of a circulating warm air type fireplace, is intended for installation in accordance with the National Fire Protection Association Standard (NFPA No. 90B).

3408.7.12.3 Fixed blowers: Fixed blowers and other electrical accessories for factory-built fireplaces shall conform to the Massachusetts State Electrical Code, 527 CMR 12.00.

3408.7.13 Steel fireplace liners: Steel fireplace units incorporating a firebox liner of not less than one-quarter (1/4) inch steel in thickness and an air chamber may be installed with masonry to provide a total thickness at the back and sides of not less than eight (8) inches, of which not less than four (4) inches shall be of solid masonry. Warm air ducts employed with steel fireplace units of the circulating air type shall be constructed of metal or masonry. A noncombustible, fire chamber bottom, should be provided if not included with the liner.

SECTION 3409.0 SOLID FUEL BURNING HEATING APPLIANCES

3409.1 General: Solid fuel burning heating appliances shall be tested and labeled in accordance with this code, the applicable standards listed in RS-21-14 and the applicable Rules and Regulations of the BBRS. These units are for attachment to a residential type chimney (see Section 3408.0).

3409.2 Definitions:

1. Central heating appliance: A solid or solid/liquid fueled boiler or warm air furnace tested to the applicable standards listed in Appendix A, RS-21-14 and contained in the applicable Rules and Regulations of the BBRS.
2. Circulating: A solid fuel burning heating appliance in which the fire chamber is surrounded by a jacket so that air flows past the fire chamber by convection or by forced circulation, or a radiant stove with a heat shield.
3. Fireplace insert: A piece of heating equipment inserted entirely and sealed into a completed masonry fire place fire chamber to adapt the fireplace for circulating warm air use and designed solely for that purpose.

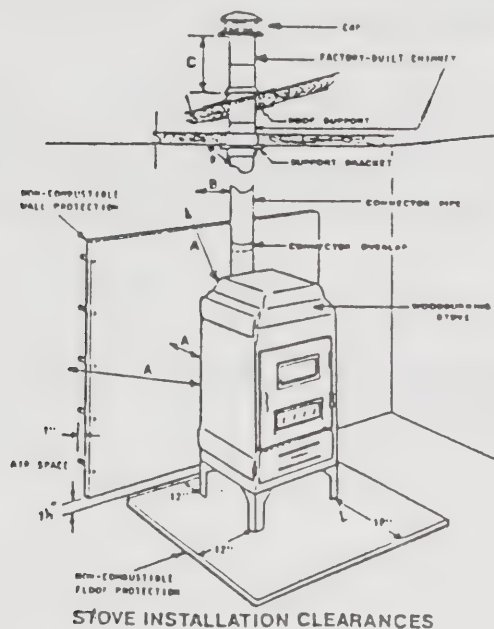
Notes:

- a. Door assemblies, grills, duct work or mechanical blowers need not be entirely confined to the fire chamber so long as they do not serve as direct sources of radiant heat.
 - b. There are no test standards or labeling requirements for this type of fireplace insert.
 - c. A building permit is required for the installation of this type of fireplace insert.
4. Radiant: A solid fuel burning heating appliance in which the exterior wall of the fire chamber directly radiates the heat to the room.
 5. Room heater: A freestanding fire chamber assembly of the circulating or direct radiation type tested to UL 1482 and/or ANSI/UL 737 as applicable. A room heater shall not be connected to duct work or other heat distribution equipment which would make it function as a central heating appliance.

3409.3 Hearth: For a solid fuel low heat appliance the floor shall be of masonry or other noncombustible construction with not less than one (1) hour fireresistance and shall extend twelve (12) inches beyond the appliance on all sides and at least eighteen (18) inches on the fuel and ash access side.

3409.4 Appliance clearance: Clearance shall be provided from combustible construction adjacent to heating appliances and equipment not less than thirty-six (36) inches at the top, twelve (12) to thirty-six (36) inches at the sides and rear, and twenty-four (24) to thirty-six (36) inches at the front (clearance dependent on whether appliance is circulating or radiant type). The clearance from material may be decreased when exposed construction is protected with noncombustible materials to afford the fire protection resistance (see Figure 3409-4 and Tables 3410-1 and 3410-2) or may be reduced to manufacturer's tested clearances.

**FIGURE 3409-4
CLEARANCES FOR SOLID FUEL BURNING APPLIANCES**



Stove components	Combustible Material	1/4" asbestos millboard spaced out 1" ³	Concrete/Masonry foundation wall	4" brick veneer spaced out 1"
Radiant stove - ¹ front	36"	-	-	-
Circulating stove ¹ - front	24"	-	-	-
A. radiant stove ⁴ - side/back	36"	18"	6"	18"
A. circulating stove - side/back	12"	6"	6"	6"
B. single wall ² connector pipe	18"	12"	6"	8"
B. insulated connector pipe	2"	2"	2"	2"
C. Chimney height (metal or masonry)	Three (3) feet above adjacent roof and two (2) feet above any roof ridge within 10 feet			
D. Damper	If a damper is not included in the stove construction, it must be installed in the connector pipe			

Note 1. Front: Fuel or ash access side.

Note 2. Thimble required for passage through combustible construction.

Note 3. Non-combustible spacers required.

Note 4. Clearances on each side of a radiant stove with a heat shield shall be measured as if a circulating type.

3409.5 Combustion air source: Combustion air may be obtained from interior spaces when volume in cubic feet is equal to one-twentieth (1/20) of the output Btu rating of all solid fuel burning heating appliances in the space.

3409.6 Solid fuel burning room heater installed in fireplaces: If a solid fuel burning room heater is set in front of a fireplace to use the existing chimney, the stove pipe must be connected either into the open damper through a snug fitting noncombustible seal or through a noncombustible fireplace opening closure which seals off the fireplace.

Both methods of installation must have access for cleanout.

3409.7 Used solid fuel burning room heaters: Used solid fuel burning room heaters which are not labeled after July 1, 1979 must be inspected and approved prior to installation by the local building official or fire official and installed in accordance with the provisions of this code.

3409.8 Solid fuel burning room heater labeling: Every solid fuel burning room heater shall bear a permanent and legible factory-applied label supplied to the manufacturer and controlled by an approved testing laboratory containing the following:

1. Manufacturer's name and trademark
2. Model and/or identification number of the appliance
3. Type of fuel(s) approved
4. Testing laboratory's name or trademark and location
5. Date tested
6. Clearance to combustibles
 - a. Side
 - b. Rear
7. Test standard
8. Label serial number

3409.9 Central heating appliance installation: Solid or solid/liquid fueled heating (central heating) appliances installed into an existing liquid or gas-fueled central heating system shall be positioned downstream of the existing appliance. Clearances to combustible materials shall be provided in accordance with the requirements specified on the label affixed to the central heating appliance (see Section 3409.3.2.7).

3409.10 Ducts for solid or solid/liquid fueled central heating appliances

3409.10.1 Supply ducts: Supply ducts conveying heated conditioned air shall be fabricated of noncombustible material.

3409.10.2 Hot air ducts: Hot air ducts shall have a clearance of not less than twelve (12) inches from combustibles for the first ten (10) feet of distance from the appliance plenum/bonnet.

34.09.10.3 Ducts: All ducts shall be otherwise constructed, installed, supported and insulated as required by this code.

3409.11 Central heating appliance labeling: Every solid or solid/liquid fueled boiler or warm air furnace shall bear a permanent and legible factory applied label, supplied to the manufacturer and controlled by an approved testing laboratory, containing the following information:

1. Manufacturer's name or trademark
2. Model/identification name or number of the appliance
3. Types of fuel(s) approved
4. Testing laboratory's name or trademark and location
5. Date tested
6. Clearance to combustibles:
 - a. side
 - b. rear
 - c. top
 - d. front
7. Test standard(s)
8. Label serial number
9. Type of appliance (boiler or warm air furnace)
10. Every boiler, pressure vessel, or pressure relief device must be stamped in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. ASME stamping shall also be required for boilers, pressure vessels and pressure relief devices produced outside the United States of America. Where required by the ASME Boiler and Pressure Vessel Code, ASME stamping may be affixed directly to the appliance in lieu of on the data plate.

Note: Additional information as required by the applicable test standard(s) may be affixed separately.

3409.11.1 Exceptions: Prior to January 1, 1981, the following exceptions shall apply:

1. ASME stamping shall not be required.
2. Solid or solid/liquid fueled central heating appliances shall be considered acceptable only if they have been tested and labeled by a laboratory accredited by the Commission to test other comfort heating appliances; or any nationally recognized laboratory.

SECTION 3410.0 MECHANICAL EQUIPMENT GENERAL

3410.1 General: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

3410.2 Commonwealth of Massachusetts regulations: All installation of gas appliances must comply with 248 CMR 3.00 - 8.00 (Massachusetts Fuel Gas Code). The construction, installation and operation of oil burning equipment is subject to the provisions of 527 CMR 4.00 established in accordance with Chapter 148, Section 10 of the MGLA, as amended. The construction, installation, testing and inspection of boilers, air tanks, ammonia compressor valves, and refrigeration and air-conditioning systems of twenty (20) tons or more capacity are subject to the Rules and Regulations issued by the Board of Boiler Rules under authority of Chapter 146 of the MGLA, as amended.

3410.3 Cooperating agencies: Nothing herein contained shall be deemed to nullify the provisions of other legal statutes or regulations of the Commonwealth of Massachusetts governing the operation and maintenance of boilers and other heating appliances and equipment.

3410.4 Labeled heating and cooking appliances: Approved oil-fired warm air furnaces, floor furnaces, unit heaters, domestic incinerators, cooking and heating stoves and ranges and other heating equipment, inspected and approved by approved agencies shall be accepted by the building official when installed with the clearances provided in Table 3410-1 and in accordance with their listings.

3410.5 Type of fuel: Each comfort heating appliance shall be designed for use with the type of fuel to which it will be connected. Appliances shall not be converted from the fuel specified on the rating plate for use with a different fuel without securing reapproval from the building official and as recommended by the manufacturer of either the original equipment or the conversion equipment.

3410.6 Shutoff valve: A readily accessible approved shutoff valve shall be installed ahead of the union or other connection in the fuel piping outside and within three (3) feet of the appliance.

Exception: Shutoff valves may be accessibly located inside or under an appliance provided the appliance can be removed without removal of the shutoff valve.

3410.7 Appliance Installation: Except as otherwise provided in this article or the basic code, the installation of comfort heating appliances shall conform to the conditions of their listing. The manufacturer's installation and operating instructions shall remain attached to the appliance.

3410.8 Appliance access: Comfort heating appliances shall be accessible for inspection, service, repair and replacement without removing permanent construction. Not less than thirty (30) inches working space and platform shall be provided in front of the appliance firebox opening of fuel burning appliances except unit and room heaters which must have a minimum of eighteen (18) inches.

3410.9 Control devices: Automatic gas-burning comfort heating appliances shall be equipped with listed devices which will shut off the gas to the main burner or burners in the event of pilot failure.

Exception: The listed shutoff devices shall not be required on range or cooking tops, log lighters, or other open burner manually operated appliances, or listed appliances not requiring such devices.

3410.9.1 Safety controls: Liquid fuel burning appliances shall be equipped with primary safety controls which will shut off flow of fuel to the burners in the event of ignition failure.

3410.9.2 Remote controls: Comfort heating fuel burning appliances whose manual fuel controls are not readily accessible from the main portion of the building being heated shall be equipped with remote controls.

3410.9.3 Temperature limit control: Forced-air and gravity-type warm-air furnaces shall be equipped with a listed air outlet temperature limit control which cannot be set for temperatures higher than 250° F. The controls shall be located in the bonnet or plenum, within two (2) feet of the discharge side of the heating element of gravity furnaces or in accordance with the conditions of listing.

3410.10 Ranges - vertical clearance above cooking top: Domestic freestanding or built-in ranges shall have a vertical clearance above the cooking top of not less than thirty (30) inches to unprotected combustible material. When the underside of such combustible material is protected with asbestos millboard at least one-quarter (1/4) inch thick covered with sheet metal of not less than No. 28 U.S. gauge or a metal ventilating hood, the distance shall be not less than twenty-four (24) inches.

3410.11 Ranges - horizontal clearance to built-in top cooking units: The minimum horizontal distance from the center of the burner head(s) of a top (or surface) cooking unit to surrounding top or surface shall be not less than that distance specified by the permanent marking on the unit.

3410.12 Open top broiler units: Listed open top broiler units and hoods shall be installed in accordance with their listing and the manufacturer's instructions.

3410.13 Domestic clothes dryers

3410.13.1 General: Where a clothes dryer is connected to a moisture exhaust duct, it shall be installed in accordance with manufacturer's instructions and recommendations.

1. A clothes dryer moisture exhaust duct shall not be connected into any vent connector, gas vent or chimney.
2. Ducts for exhausting moisture from clothes dryers shall not be constructed with sheet metal screws or other fastening means which extend into the duct.
3. In no case shall the moisture exhaust terminate beneath the building or in the attic.
4. Domestic clothes dryers shall be moisture exhausted to the outside when located in a habitable room or room containing other fuel burning appliances.

3410.14 Fuel-burning appliance labeling: Every fuel burning comfort heating appliance shall bear a permanent and legible factory applied nameplate on which shall appear:

1. the manufacturer's name or trademark;
2. the model and serial number;
3. instructions for the lighting, operation and shut-down of the appliance;
4. the type of fuel approved for use with the appliance; and
5. a seal indicating approval of the appliance by an approved testing agency, if acceptance is based on such approval.

3410.15 Electrical appliance labeling: Every electric appliance listed in Table 3410-1 shall bear a permanent and legible factory applied nameplate on which shall appear:

1. name or trademark of the manufacturer;
2. the catalog (model) number or equivalent;
3. the electrical rating in volts, amperes and phase;
4. individual marking for each electrical component in amperes or watts, volts and phase shall appear on the nameplate of that component.

3410.16 Appliance protection: Boilers, furnaces, hot water heaters or any other appliances having an open flame or exposed heated surfaces shall not be located in a private garage unless precautions are taken to protect such equipment from impact by automobiles. This equipment shall have the combustion chamber, ash pit, etc., raised a minimum of eighteen (18) inches above the floor to eliminate a possible source of ignition.

Exception: Sealed combustion system appliances may be installed at floor level.

TABLE 3410-1
STANDARD INSTALLATION CLEARANCES FOR HEAT-PRODUCING APPLIANCES

These clearances apply unless otherwise shown on listed appliances. Appliances shall not be installed in alcoves or closets unless so listed. For installation on combustible floors, see footnote 2.

Residential type appliances For installation in rooms which are large		APPLIANCES (all dimensions in inches)					Chimney Connector	Vent Connector ⁵
		Above top of casing or appliance	From top & sides of warm-air bonnet or plenum	From front ⁴	From back	From sides		
Boilers & Water Heaters ⁶ Fuel								
Steam boilers - 15 psi Water boilers - 250°F Water heaters - 200° F. All water walled or jacketed	Automatic oil or combination gas & oil	6	-	24	6	6	18	-
	Automatic gas	6	-	18	6	6	-	9
	Solid	6	-	48	6	6	18	-
Furnaces - Central								
Gravity, upflow, downflow, horizontal & duct Warm air - 250°F, maximum Limit control	Automatic oil or combination gas & oil	6 ¹	6 ¹	24	6	6	18	-
	Automatic gas	6 ¹	6 ¹	18	6	6	-	9
	Solid	18 ⁶	18 ⁶	48	18	18	18	-
	Electric	6 ¹	6 ¹	18	6	6	-	-
Furnaces - Floor								
For mounting in combustible floors	Automatic oil or combination gas & oil	36	-	12	12	12	18	-
	Automatic gas	36	-	12	12	12	-	9
Heat Exchangers - Supplied From A Remote Source								
Steam - 15 psi maximum Hot water - 250°F, maximum		1	1	1	1	1	-	-
Room Heaters & Room Heating Stoves Burning Solid Fuel								
Circulating type Vented or unvented	Oil or solid	36	-	24	12	12	18	-
	Gas	36	-	24	12	12	-	9
Radiant or other type Vented or unvented	Oil or solid	36	-	36	36	36	18	-
	Gas	36	-	36	18	18	-	9
	Gas with double metal or ceramic back	36	-	36	12	18	-	9
Radiators, Self-Contained								
Steam or hot water	Gas	36	-	6	6	6	-	9
Ranges - Cooking Stoves								
Vented or unvented	Oil	30	-	-	9	9 24	18	-
	Gas	30	-	-	6	6 6	-	6
	Solid-clay lined fireport	30	-	-	24	24 18	18	-
	Solid unfired fireport	30	-	-	36	30 18	18	-
	Electric	30	-	-	6	6	-	-
Clothes Dryer								
Listed types	Gas	6	-	24	6	6	-	1
	Electric	6	-	24	0	0	-	-

Notes to Table 3410-1

Note 1. Standard clearances may be reduced in existing construction only by affording protection to combustible material in accordance with Table 3410-2.

Note 2. An appliance may be mounted on a combustible floor if the appliance is listed for such installation or if the floor is protected in an approved manner.

Note 3. Rooms which are large in comparison to the size of the appliance are those having a volume equal to at least twelve(12) times the total volume of a furnace and at least sixteen(16) times the total volume of a boiler. If the actual ceiling height of a room is greater than eight (8) feet, the volume of a room shall be figured on the basis of a ceiling height of eight(8) feet.

Note 4. The minimum dimension shall be that necessary for servicing the appliance including access for cleaning and normal care, tube removal, etc.

Note 5. The minimum dimension shall be eighteen (18) inches for gas appliances not equipped with draft hoods, except clothes dryers. The dimension may be six (6) inches for listed gas appliances equipped with draft hoods and for boilers and furnaces equipped with listed conversion burners and with draft hoods. A vent connector of listed Type B or L venting material may be used with listed gas appliances with draft hoods and may be installed at clearances marked on the material.

Note 6. Steam pipes and hot-water heating pipes shall be installed with a clearance of at least one (1) inch to all combustible construction or material, except that at the points where pipes carrying steam or hot water at not over fifteen (15)pounds gauge pressure emerge from a floor, wall, or ceiling, the clearance at the opening through the finish floor boards or wall ceiling boards may be reduced to not less than one-half (1/2)inch. Each such opening shall be covered with a plate of noncombustible material.

Such pipes passing through stock shelving shall be covered with not less than one (1) inch of approved insulation.

Wood boxes or casings enclosing uninsulated steam or hot water heating pipes, or wooden covers to recesses in walls in which such uninsulated pipes are placed, shall be lined with metal or asbestos millboard.

Where the temperature of the boiler piping does not exceed one hundred sixty (160) degrees F., the provisions of this table shall not apply.

Coverings or insulation used on steam or hot water pipes shall be of noncombustible material.

Note 7. For a listed oil, combination gas-oil, gas or electric furnace, this dimension may be two (2) inches if the furnace limit control cannot be set higher than two hundred fifty (250)degrees F., or this dimension may be one (1) inch if the limit control cannot be set higher than two hundred (200) degrees F.

Note 8. The dimension may be six (6) inches for an automatically stoker-fired forced warm-air furnace equipped with two hundred fifty (250) degrees F. limit control operated by draft intensity of .13-inch water gauge.

Note 9. To combustible material or metal cabinets. If the underside of such combustible material or metal cabinet is protected with asbestos millboard at least one-quarter (1/4) inch thick covered with sheet metal of not less than No. 28 gauge,the distance may be not less than twenty-four (24) inches.

TABLE 3410-2
MAXIMUM REDUCED CLEARANCES (INCHES) WITH
SPECIFIED FORMS OF PROTECTION¹

Type of Protection Applied to the combustible material unless otherwise specified and covering all surfaces within the distance specified as the required clearance with no protection. (Thicknesses are minimum)	WHERE THE REQUIRED CLEARANCE WITH NO PROTECTION IS:							
	36 inches			18 inches			12 inches	
	Above	Sides and Rear	Chimney or vent connector	Above	Sides and Rear	Chimney or vent connector	Above	Sides and Rear
a. 1/4" asbestos millboard spaced out 1"	30	18	30	15	9	12	9	6
b. No. 28 manufacturers' standard gage steel sheet on 1/4" asbestos millboard	24	18	24	12	9	12	9	6
c. No. 28 manufacturers' standard gage steel spaced out 1"	18	12	18	9	6	9	6	4
d. No. 28 manufacturers' standard gage steel on 1/8" asbestos millboard spaced out 1"	18	12	18	9	6	9	6	4
e. 1/4" asbestos millboard on 1" mineral fiber batts reinforced with wire mesh or equivalent	18	12	18	6	6	6	4	4
f. No. 22 manufacturers' standard gage steel sheet on 1" mineral fiber batts reinforced with wire or equivalent	18	12	12	4	3	3	2	2
g. 1/4" asbestos cement board or 1/4" asbestos millboard	36	36	36	18	18	18	12	12
h. 1/4" cellular asbestos	36	36	36	18	18	18	12	12

Note 1. Except for the protection described on (e), all clearances shall be measured from the outer surface of the appliance to the combustible material disregarding any intervening protection applied to the combustible material.

Note 2. Spacers shall be of non-combustible material.

SECTION 3411.0 COMBUSTION AIR

3411.1 General: All fuel burning equipment shall have a sufficient supply of air for fuel combustion, ventilation draft hood dilution.

3411.2 Volume required: Additional combustion air shall be provided for fuel burning appliances if the volume of an appliance room in cubic feet is less than one-twentieth ($1/20$) of the maximum input Btu rating of all appliances therein.

Exception: Sealed combustion system appliances, cooking appliances, refrigerators and clothes dryers.

3411.3 Air supply: Rooms containing fuel-burning appliances and not having the volume required in Section 3411.2 shall be provided with two (2) square inches of combustion air opening for each input of one thousand (1000) Btu rating with a total of not less than two hundred (200) square inches.

Exception: One (1) square inch for each input rating of one thousand (1000) Btu's may be permitted provided the compartment floor area is more than twice the floor area of the appliance and the total area is not less than one hundred (100) square inches.

3411.3.1 Air supply ratio: One-half ($1/2$) of the required combustion air opening shall extend within the upper twelve (12) inches of the room and the other one-half ($1/2$) shall extend within the lower twelve (12) inches.

Exception: In any room containing gas or liquid burning appliances which has more than twice the floor area of all such appliances, the required combustion air supply may be reduced fifty (50) per cent, but not less than one hundred (100) square inches and in all rooms larger than fifty (50) square feet the required combustion air opening may be located within the upper twelve (12) inches of the room.

3411.4 Outside combustion air: If required, outside combustion air shall be supplied through openings or ducts of the required cross-sectional area extending to the appliance room. The same duct shall not serve both the upper and lower combustion air supply openings.

The duct serving the upper air opening must be level or extended upward from appliance room.

3411.5 Attic combustion air: Combustion air supply may be obtained from an attic area provided:

1. The attic ventilation is sufficient to provide the required volume of combustion air.

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2. Circulating air supplies for blower-type furnaces shall not be obtained from the area.

3411.6 Under floor combustion air: The lower combustion air supply required by Section 3411.3 may be obtained from under floor areas having unobstructed openings to the outside equivalent to not less than twice the required combustion air opening between the under floor space and the appliance room.

3411.7 Opening requirements: Outside combustion air openings shall be covered with corrosion-resistant screen of one-quarter (1/4) inch mesh.

3411.8 Combustion air ducts: Combustion air supply ducts shall be of corrosion-resistant material having a cross-sectional dimension of not less than three (3) inches and terminating in a space not less than six (6) inches in depth in front of, or open to, the front or firebox side of the appliance. The space shall extend from the floor to the ceiling of the appliance room.

3411.9 Gravity-type warm-air furnaces: Gravity-type warm-air furnaces shall be provided with combustion air supply specified in section 3411.0.

3411.10 Exhaust and ventilation systems: Air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements.

3411.11 Cold climate: Appliance rooms of unusually tight construction located in areas where temperatures prevail at lower than 20° F., may be provided with combustion air as set forth in Table 3411-1. Openings shall conform to Section 3411.3.

Exception: Sealed combustion systems.

TABLE 3411-1
APPLIANCE ROOM COMBUSTION AIR REQUIREMENTS
IN COLD CLIMATES (TIGHT CONSTRUCTION)

Type of Opening	Minimum total free area of ducts or openings, where volume of compartment is less than 16 times of the appliance therein	Minimum total free area of ducts or openings, where volume of compartment is more than 16 times of the appliance therein
Direct opening or vertical ducts to outside	1 sq. inch for each 4,000 BTU's	1 sq. inch for each 5,000 BTU's
Horizontal ducts to outside	1 sq. inch for each 2,000 BTU's	1 sq. inch for each 2,500 BTU's
To inside of building ¹	1 sq. inch for each 1,000 BTU's	1 sq. inch for each 2,000 BTU's

Note 1. Combustion air shall be taken from other interior areas complying with Section 3410.2.

SECTION 3412.0 WARM-AIR FURNACE

3412.1 Installation: A direct-fired furnace shall not be located downstream from a refrigerant evaporator or other air cooling coil unless the heating equipment is listed for such use.

3412.1.1 A refrigerant evaporator or cooling coil shall not be located in the air discharge of a warm-air furnace except where the furnace is listed for operation at not less than 0.5-inch water column static pressure or for use with a cooling coil.

3412.1.2 Furnace conversion: Conversion of existing furnaces for use with cooling coils shall be permitted only if approved by the building official.

3412.2 Combustion air: Fuel burning warm-air furnaces shall be supplied with adequate combustion air as required by Section 3411.0 of this article.

3412.2.1 Separation: The combustion chamber opening shall be separated from the fan plenum of a forced air furnace by an airtight separation.

3412.3 Working space: A working space not less than thirty (30) inches deep and thirty (30) inches high shall be provided to the front or firebox side of all furnaces.

3412.3.1 Access space: A space not less than twenty-four (24) inches wide and thirty (30) inches high shall be provided to the access panel to the temperature limit

control, air filter and where applicable, fuel control valve. A space not less than twenty-four (24) inches wide and eighteen (18) inches high shall be provided to the vent collar of fuel burning furnaces.

3412.4 Prohibited location: Warm-air furnaces shall not be located in a bedroom, bathroom, closet or confined space with access only to such room or space.

Exceptions:

1. Access to attic or underfloor furnaces may be through a closet.
2. Sealed combustion systems.
3. Enclosed furnaces.
4. Electric furnaces.

3412.5 Room access: Any room containing a warm-air furnace shall have access thereto by a door and passageway of not less than two (2) feet by six (6) inches and large enough to permit removal of equipment.

Exception: Underfloor and attic installations.

3412.6 Clearance of warm-air furnaces: Clearances shall be provided for warm-air furnaces in accordance with the requirements of Table 3410-1 or their listing. The clearance of the combustion chamber opening side shall be not less than six (6) inches for fuel burning appliances.

3412.7 Attic furnaces: A warm-air furnace installed in an attic less than five (5) feet in height shall be listed for that location.

3412.7.1 Equipment access: A passageway thirty (30) inches by thirty (30) inches minimum shall be provided from the attic opening to the furnace and its controls. The opening and passageway shall be large enough to allow replacement of any part and the attic opening shall not be located more than twenty (20) feet from the furnace measured along the center line of the passageway. The passageway shall be unobstructed and have solid flooring not less than twenty-four (24) inches wide.

3412.8 Underfloor furnaces: Warm-air furnaces installed in the underfloor area shall comply with the following requirements:

1. An access opening and passageway shall be provided of sufficient height and width to permit removal of the furnace but not less than thirty (30) inches by thirty (30) inches and which extends to the working space in front of the furnace. The distance from the passageway opening to the heating equipment shall not exceed twenty (20) feet.
2. Furnaces supported on the ground shall rest on concrete or masonry

bases extending not less than three (3) inches above the adjoining ground level.

3. Furnaces suspended from the building shall have a clearance of at least six (6) inches from the ground. Furnace excavations shall extend to a depth of not less than six (6) inches below and twelve (12) inches beyond the sides of the furnace, except that the control side shall have a clearance of not less than thirty (30) inches. Walls of excavations exceeding twelve (12) inches in depth shall be lined with concrete masonry extending not less than four (4) inches above the adjoining ground level. In flood plane areas not less than a twelve (12) inch clearance shall be provided between the furnace and finish grade.

3412.9 Exterior furnaces: Warm-air furnaces installed on the exterior of buildings shall be listed accordingly and comply with the following requirements:

1. Unless listed for outside installation, an appliance located on the exterior of a building shall be enclosed in a weather-resistant housing. A weatherproof housing may be constructed of No. 24 gauge galvanized steel or No. 22 gauge aluminum. The enclosure shall have not less than a six (6) inch clearance from the furnace.
2. The appliance shall be installed on a level platform.
3. For ground installations the appliance shall be supported on a concrete or masonry base extending not less than three (3) inches above the adjoining ground level.

3412.10 Circulating air supply - general: The circulating air supply shall be taken from outside the building or from the conditioned area inside the building or from both sources.

3412.10.1 Ducts: The circulating air supply for a forced air comfort heating system shall be conducted through ducts complying with Section 3415.0 or through concealed spaces provided vent or vent connectors do not extend into or through these spaces.

3412.10.2 Volume damper: A volume damper shall not be placed in the circulating air supply inlet so as to reduce the supply to the furnace.

3412.10.3 Screen covering: The outside circulating air supply inlet shall be covered with screen having one-quarter (1/4) inch openings.

3412.11 Circulating air supply - requirement: The unobstructed area of circulating air supply openings to a gravity-type warm-air furnace shall be not less than seven (7) inches for each input of one thousand (1000) Btu rating or as required by the conditions of listing.

3412.11.1 Area: The unobstructed area of circulating air supply opening or ducts to a forced air warm-air furnace shall be not less than two (2) square inches for each input of one thousand (1000) Btu rating or as required by the conditions of listing.

3412.12 Circulating air supply - source: The circulating air supply for a comfort heating system shall not be taken from the following locations:

1. Within ten (10) feet of an appliance or plumbing vent outlet which is located less than three (3) feet above the circulating air supply inlet.
2. Areas having objectionable odors, fumes or flammable vapors.
3. Areas whose volume is less than twenty-five (25) per cent of the volume served by the system and where permanent openings to supplemental areas are not provided in accordance with this section.

Exception: Openings for a warm-air furnace may be reduced to not less than fifty (50) per cent of the required circulating air supply area provided the balance is taken from a room or hall having at least three (3) doors leading to other rooms served by the furnace.

4. Areas having a direct-fired fuel burning appliance.

Exceptions:

1. A gravity-type comfort heating system.
2. A blower-type comfort heating system where the circulating air supply is taken from an area having a volume exceeding one (1) cubic foot for each ten (10) Btu's of fuel input rating of all fuel burning appliances therein and at least seventy-five (75) per cent of the conditioned air is discharged back into the area provided the circulating air supply inlet is not located within ten (10) feet of an appliance firebox or draft diverter.

3412.13 Conditioned air supply: The minimum unobstructed total area of the conditioned air ducts from a blower-type warm-air furnace shall be not less than two (2) square inches for each one thousand (1000) Btu approved hourly input rating of the furnace and the minimum unobstructed total area of the conditioned air ducts

from a gravity-type warm-air furnace shall be not less than seven (7) square inches for each one thousand (1000) Btu approved hourly input rating or as specified by the conditions of listing of the furnace.

3412.13.1 Duct sizing: In no case need the total area of the conditioned air ducts be larger than the outlet plenum collar opening on the furnace.

3412.13.2 Control: For the purpose of this section a volume damper, grill, or register installed for the purpose of controlling the conditioned air flow shall not be considered an obstruction.

**SECTION 3413.0 VENTED DECORATIVE APPLIANCES,
FLOOR FURNACES, VENTED WALL FURNACES
AND VENTED ROOM HEATERS**

3413.1 General: A vented decorative appliance, floor furnace, vented wall furnace, or vented room heater shall not be located under a stairway.

3413.2 Vented decorative appliances: Vented decorative appliances shall comply with the requirements for comfort heating appliances.

3413.3 Prohibited use: Unvented room heaters are prohibited in accordance with M.G.L.A. Chapter 148, Sections 25A and 25B, as amended.

3413.4 Floor furnaces location: Flat floor furnaces shall be installed not less than six (6) inches from walls.

3413.4.1 Wall location: Wall register floor furnaces shall be installed not less than six (6) inches from inside room corners.

Exception: Replacement floor furnaces of the same or lesser input rating may be installed in the original location when approved by the building official.

3413.4.2 Other combustible: Floor furnaces shall not be located where draperies or a door can swing within twelve (12) inches of the warm air outlet.

3413.4.3 Outlet clearances: Floor furnaces warm air outlets shall not be installed less than sixty (60) inches below overhead projections.

3413.4.4 Floor space: A clear floor space of fifteen (15) inches shall be provided along two (2) adjoining sides of flat floor furnaces.

3413.4.5 Furnace projection: The floor furnace burner assembly shall not project into an occupied underfloor area.

3413.5 Floor furnace access: An opening and passageway not less than twenty-four (24) by eighteen (18) inches shall be provided to every floor furnace. The passageway shall be not more than twenty (20) feet in length from the access opening or from an underfloor area thirty (30) inches or more in height.

3413.6 Floor furnace installation: Floor furnaces shall be supported independently of the grill and shall have not less than six (6) inches clearance from grade.

Exception: Sealed furnaces may have a grade clearance of two (2) inches minimum.

3413.6.1 Furnace excavations: Furnace excavations shall extend not less than eighteen (18) inches beyond the control side and twelve (12) inches beyond the sides and back of the furnace. The excavation shall slope outward from the bottom to the natural grade at an angle not greater than forty-five (45) degrees from the horizontal.

3413.6.2 Slab on grade: Floor furnaces shall not be installed on concrete slabs on grade.

3413.7 Wall furnace location: Vented wall furnaces designed to be installed in a nominal four (4) inch wall shall be not less than six (6) inches from inside room corners except where listed for reduced clearances.

Exception: Vented wall furnaces replacements approved by the building official.

3413.7.1 Combustible clearances: Vented wall furnaces shall not be located where a door can swing within twelve (12) inches of the furnace air inlet or outlet and shall not be installed less than eighteen (18) inches below overhead projections.

3413.8 Wall furnace combustion air: Vented wall furnaces shall be provided with combustion air in accordance with Section 3410.0.

Exception: Combustion air openings may be omitted to the area in which a vented wall furnace is installed provided a cased opening or archway leads from that area into other rooms having a minimum combined volume in cubic feet equivalent to one-twentieth (1/20) of the input Btu rating of the furnace.

3413.9 Wall furnace installation: Ducts shall not be attached to a wall furnace. Casing extensions or boots may be installed if listed as part of the appliance.

3413.10 Vented room heaters: Floor mounted type unit heaters shall be installed in accordance with Table 3410-1.

3413.11 Room heaters: Vented room heaters shall be installed in accordance with Table 3410-1 or as listed.

3413.12 Unvented room heaters: No unvented fuel burning room heaters shall be installed.

SECTION 3414.0 VENTING OF APPLIANCES

3414.1 General: All fuel burning comfort heating and comfort cooling appliances shall be vented to the outside. Venting systems shall consist of approved chimneys, approved vents or a venting assembly which is an integral part of a listed appliance or may be designed in accordance with accepted engineering practices.

3414.1.1 Vent systems: Venting systems which are integral parts of vented appliances shall be installed in accordance with the terms of their listing, manufacturer's installation requirements and applicable requirements of this article.

3414.2 Commonwealth of Massachusetts requirements: Gas vents required for appliances or equipment using fuel gases of any kind such as natural gas, manufactured gas, undiluted liquified petroleum gases, liquified petroleum gas-air mixtures, or mixtures of any of these gases shall comply with the requirements of the Massachusetts Fuel Gas Code, 248 CMR 3.00 - 8.00.

3414.3 Type of venting systems required: Gas appliances shall be vented in conformance with the regulations provided in Section 3414.2. Oil burning appliances may be used with type L vents where so listed.

3414.4 Installation and construction: Manually operated dampers shall not be placed in chimneys, vents or vent connectors of liquid or gas burning appliances. Fixed baffles on the appliance side of draft hoods and draft regulators shall not be classified as dampers.

3414.4.1 Automatically operated dampers: Automatically operated dampers shall be of approved type designed to maintain a safe damper opening and arranged to prevent firing of the burner unless the damper is opened to a safe position.

3414.5 Location: Vents shall not extend into or through an air supply duct or plenum.

Exception: Venting systems may pass through a combustion air duct.

3414.5.1 Multiple connections: Appliances shall not be vented into a fireplace or into a chimney serving a fireplace.

3414.6 Length pitch - clearance: Gravity vents shall not have more than two (2) offsets of more than forty-five (45) degrees from the vertical.

3414.6.1 Horizontal run: The horizontal run of a gravity vent and its connectors shall not be greater than seventy-five (75) per cent of the vertical height of the venting system measured from the appliance outlet.

3414.6.2 Vent connectors: Vent connectors in gravity-type venting systems shall have continuous rises of not less than one-quarter (1/4) inch per foot of length measured from the appliance vent collar to the vent.

3414.6.3 Single wall connectors: Single wall metal vent connectors for an appliance shall be located entirely within the room or area where the appliance is located.

3414.7 Vent termination - general: Vents shall extend above the roof surface, through a flashing and terminate in a listed vent cap.

3414.8 Gravity vent termination: Gravity-type venting systems, other than Type BW or venting systems which are integral with listed appliance, shall terminate not less than five (5) feet above the highest vent collar which they serve.

3414.9 B or BW vent termination: Type B or BW gas vents shall terminate not less than one (1) foot above the roof nor less than four (4) feet from a portion of the building which extends at an angle of more than forty-five (45) degrees upward from the horizontal.

3414.10 L vent termination: Type L venting systems shall terminate not less than two (2) feet above the roof nor less than four (4) feet from a portion of the building which extends at an angle of more than forty-five (45) degrees upward from the horizontal.

3414.11 Special vent requirements: Venting systems shall terminate not less than four (4) feet below, four (4) feet horizontally from or one (1) foot above a door, window or gravity air inlet into a building.

Exception: Venting systems which are integral parts of listed equipment may be located closer provided the door, window or gravity air inlet is serving the same room in which the appliance is located; the venting system does not terminate less than nine (9) inches from the door, window or gravity air inlet; and the appliance does not exceed an input rating of fifty thousand (50,000) Btu's.

3414.11.1 Inlet and property clearance: Venting systems shall terminate not less than three (3) feet above forced air inlets located within ten (10) feet (horizontally); nor less than four (4) feet from private property lines.

3414.12 Vent size: Vent systems shall have internal cross-sectional areas of not less than the area of the vent collars but not less than seven (7) square inches except where the vents are integral parts of listed appliances.

3414.13 Multiple appliance venting systems: Two (2) or more listed appliances may be connected to common gravity-type venting systems provided the appliances are equipped with listed primary safety controls and listed safety shutoff devices for oil and gas fuel respectively and comply with the following requirements:

1. Appliances which are connected to common venting systems shall be located in the same story of the building, except engineered systems as set forth in Section 3414.1.
2. Two (2) or more connectors shall not enter common venting systems unless the inlets are offset so that no portion of an inlet is opposite the other inlets.
3. The venting system shall be not less than the area of the largest vent connector plus fifty (50) per cent of the areas of the additional vent connectors. An oval vent may be used provided its capacity is not less than the capacity of the round vent for which it is substituted.

3414.14 Existing venting systems: Existing venting systems may be connected to replaced appliances in accordance with the following requirements:

1. The venting system shall have been installed in accordance with the code in effect at that time and have no apparent defects.
2. The internal area of the venting systems shall be in accordance with Section 3414.11.

3414.15 Draft hoods: Draft hoods shall be located in the same room or space as the combustion air openings of the appliances and shall be located so that the relief opening is not less than six (6) inches from any surface other than the appliance it serves, measured in a direction ninety (90) degrees to the plane of the relief opening.

SECTION 3415.0 DUCTS

3415.1 Material: Ducts conveying air from outside the building or air from evaporative coolers shall be constructed of galvanized steel or corrosion-resistant metal.

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3415.1.1 Other material: Ducts or concealed spaces used for inside circulating air may be of combustible material. Where space between studs in walls or partitions is used as a duct the portions of such space so used shall be cut off from all remaining unused portions by tight-fitting stops of sheet metal or of wood not less than two (2) inches nominal thickness. Not more than one (1) firestop may be crossed.

3415.1.2 Hot air ducts: Ducts conveying heated conditioned air shall be of noncombustible material.

3415.1.3 Other approved ducts: Approved ducts, plenums and fittings constructed of asbestos-cement, concrete or ceramic may be installed in the ground or in a concrete slab.

3415.1.4 Other criteria: Metal ducts shall conform to Table 3415-1.

3415.1.5 Temperature: Ducts constructed of gypsum products shall not be subject to air temperatures of more than 125° F.

3415.2 Construction: Duct work shall be constructed in accordance with the criteria contained in Appendix B of the code.

3415.3 Installation: Metal ducts shall be securely fastened in accordance with Table 3415.3.

3415.3.1 Metal ducts shall not be installed within four (4) inches of the ground except when encased in not less than two (2) inches of concrete.

3415.3.2 Duct Supports: Rectangular metal duct supports set forth in Table 3415.3 shall be riveted, bolted or screwed to each side of the duct.

3415.3.3 Other supports: Horizontal round duct supports set forth in Table 3415-3 shall consist of one (1) hanger installed in accordance with the following requirements:

1. The hanger shall be attached to one (1) inch wide circular bands of same gauge as duct extending around and supporting ducts exceeding ten (10) inches in diameter.
2. The ducts shall be braced to prevent lateral displacement.

3415.4 Insulation: Ducts shall be insulated, when required, according to Section 3428.1.

Exception: Ducts need not be insulated in an unheated basement or cellar when foundation walls are insulated.

SECTION 3416.0 COMFORT COOLING

3416.1 Commonwealth of Massachusetts Rules and Regulations: All installations of gas appliances shall be subject to and must comply with the Massachusetts Fuel Gas Code, 248 CMR 4.00 - 8.00. All oil burning appliances shall be subject to the provisions of 527 CMR 4.00 established in accordance with Chapter 148, Section 10 of the MGLA, as amended, which govern the construction, installation and operation of oil burning equipment. Also, compliance shall be required with the provisions of the rules and regulations issued by the Board of Boiler Rules under the authority of Chapter 146 of the MGLA, as amended, governing the construction, installation, testing and inspection of boilers, air tanks, ammonia compressor safety valves, and refrigeration and air-conditioning systems of twenty (20) tons or more capacity.

3416.2 Cooperating agencies: Nothing herein contained shall be deemed to nullify the federal, state or municipal rules and regulations governing the storage and use of flammable and explosive gases and chemicals, or the requirements of the Interstate Commerce Commission or other federal statutes governing the transportation and use of hazardous gases, explosives and other flammable substances.

3416.3 Permits: One- and two-family dwellings shall not be required to have permits unless the refrigeration systems contain more than ten (10) pounds of refrigerants or are actuated by motors or engines of one and one-half (1-1/2) horsepower or larger.

3416.4 Installation: Group 2 refrigerants shall not be used in direct refrigerating systems.

TABLE 3415-1
GAGES OR METAL DUCTS AND PLENUMS USED FOR
COMFORT HEATING OR COOLING FOR A DWELLING UNIT

	Comfort Heating or Cooling		
	Galvanized Steel		Approximate Aluminum B & S Gage
	Nominal Thickness (inches)	Equivalent Galvanized sheet gage number	
Round ducts and enclosed rectangular ducts 14" or less Over 14"	0.016	30	26
	0.019	28	24
Exposed rectangular ducts 14" or less Over 14"	0.019	28	24
	0.022	26	23

TABLE 3415-3
METAL DUCT SUPPORTS

Duct Type	Max. Side or Dia.	Duct Position	Hangar or Strap Size & Spacing
Circular	10'	Vertical	No. 18 gage galvanized steel x 2" @ 12' o.c.
		Horizontal	No. 30 gage galvanized steel x 1" or No. 18 steel wire @ 12' o.c.
	20'	Vertical	No. 16 gage galvanized steel x 2" @ 10' o.c.
		Horizontal	No. 28 gage galvanized steel x 1" or No.18 steel wire @ 10' o.c.
Rectangular	24'	Vertical	1' x 1/8" steel galvanized strap @ 12' o.c.
		Horizontal	No 18 gage galvanized steel x 1" @ 10' o.c.
	36'	Vertical	1" a 1-1/8 steel galvanized angle @ 12' o.c.
		Horizontal	1" x 1/8" steel strap galvanized 10' o.c.

3416.4.1 Condensate: An approved means shall be provided for the collection and disposal of condensate from the air cooling coil to outside the building or other approved locations.

3416.4.2 Location: Comfort cooling equipment, other than ducts and piping, shall be located not less than three (3) inches above the ground.

3416.4.3 Lighting: Electric lighting shall be provided for equipment located inside a building.

3416.5 Access: Equipment requiring servicing shall be accessible by means of passageway two (2) feet by six (6) feet six (6) inches minimum.

Exception: An access opening to the attic or underfloor area may be reduced to a thirty (30) inch dimension provided the equipment can be replaced.

3416.5.1 Work space: Equipment shall be provided with an unobstructed space thirty (30) inches by six (6) feet six (6) inches minimum on the service side.

Exception: The height of the working space may be reduced to thirty (30) inches for an air handling unit, air filter or refrigerant and brine control valves. Fan coils in drop ceilings may be serviced through combination return air grills.

3416.6 Circulating air supply source: A positive separation shall be provided between the combustion air and the circulating air supply (see Section 3412.10).

3416.7 Return air limitation: Comfort cooling systems shall be arranged so that the circulating air from one (1) dwelling unit does not discharge into another dwelling unit.

3416.8 Screen: Exterior circulating air supply inlets shall be covered with screen having one-quarter (1/4) inch openings.

3416.9 Refrigerant piping: All refrigerant pipe and fittings installed within a building or structure and which may reach surface temperatures that will result in condensation forming on the piping shall be insulated.

**SECTION 3417.0 ABSORPTION UNITS AND
ABSORPTION SYSTEMS FOR COMFORT
COOLING AND COMFORT HEATING**

3417.1 General: Absorption units used for comfort heating or comfort cooling systems shall conform to the requirements of Sections 3410.0, 3411.0 and 3415.0.

3417.2 Identification: Fuel burning absorption units shall bear a label containing the following information:

1. Manufacturer's name
2. Model number
3. Amount and type of refrigerant
4. Factory test pressures or pressures applied
5. Normal Btu input rating
6. Cooling capacity in Btu's
7. Type of fuel
8. Symbol of the organization certifying the approval of the equipment
9. Instructions for the lighting, operation and shutdown of the system

SECTION 3418.0 FUEL SUPPLY SYSTEMS

3418.1 General: New fuel supply systems, except parts thereof controlled and maintained by a public utility, shall conform to the requirements of this section and shall not be made operative until first approved by the building official. Fuel supply system design, construction and workmanship shall be consistent with generally accepted good practice and in conformity with nationally recognized applicable standards acceptable to the BBRs.

3418.2 Location: Location of fuel supply tanks, meters, main shutoff valves, relief valves, and regulators other than integral appliance regulators shall be approved by the building official and shall conform to state and local regulations.

3418.3 Authority to disconnect: The building official is hereby authorized to order disconnected any fuel supply or appliance which does not conform to this code or which is found to be defective and may endanger life or property.

3418.3.1 Notice: A notice shall be attached to the piping or appliances stating the reasons for disconnection. Such notice shall not be removed nor shall the system or appliance be reconnected until authorized by the building official.

3418.4 Piping support: Gas piping shall be supported by metal straps or hooks at not more than six (6) feet on center for piping one (1) inch or less in size and not more than ten (10) feet on center for piping larger than one and one-quarter (1-1/4)

inches. Piping shall be protected against physical damage. Buried piping shall be laid in a solid bed.

Gas piping shall not be strained or bent and appliances shall not be supported by supply piping.

3418.5 Liquid fuel supply: Supply piping and all related equipment serving oil burning appliances shall be subject to the provisions of 527 CMR 4.00 (FPR-3).

SECTION 3419.0 ENERGY CONSERVATION BY COMPONENT DESIGN

3419.1 General: All buildings that are heated or mechanically cooled shall be constructed to provide the required thermal performance of the various components.

3419.2 Building enclosure elements

3419.2.1 Gross wall area: For the purposes of this article, the gross area of exterior walls consists of all opaque wall areas, including foundation walls, walls between floor spandrels, peripheral edges of floors, window areas including sash, and door areas, where such surfaces enclose a heated or mechanically cooled space including interstitial areas between two such spaces.

3419.2.2 Roof assembly: For the purposes of this article, a roof assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thereby creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses a heated or mechanically cooled space.

3419.2.3 Gross roof area: The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights exposed to the heated or mechanically cooled space.

3419.2.4 Ceiling plenums: Where air ceiling plenums are employed, the roof/ceiling assembly shall:

1. for thermal transmittance purposes, not include the ceiling proper nor the plenum space as part of the assembly; and,
2. for gross area purposes, be based upon the interior face of the upper plenum surface.

SECTION 3420.0 BUILDING INSULATION

3420.1 Standards: Insulating materials must conform to the Federal Specifications (F.S.) and the American Society for Testing and Materials (ASTM) Test Standards as listed in Table 3420-1 for thermal resistance and fire safety.

3420.2 Installation

3420.2.1 Recessed light fixtures: Only IC labeled recessed lights allowing direct contact with insulating materials may be used in areas separating conditioned and unconditioned spaces.

3420.2.2 High heat sources: A clearance of three (3) inches from any high heat source is required for combustible insulating materials, including but not limited to, chimneys, flues and vents.

3420.2.3 Liquid foams: Liquid foams must meet minimum standards set forth in HUD "Use of Materials" Bulletin No. 74.

3420.3 Foam plastics

3420.3.1 General: Except where specifically exempted by subsection 2 below, foam plastics shall have a flame spread rating of not more than 75 and shall have a smoke developed rating of not more than 450 when tested in accordance with approved standards in the thickness intended for use.

3420.3.2 Specific requirements: The following requirements shall apply to all uses of foam plastics in or on the walls, ceilings, or in attics, roof or floors, crawl spaces or similar areas, and may be used in the following locations:

1. Within the cavity of a masonry or concrete wall.
2. On the room side surface of walls or ceilings or other surfaces provided the foam plastic is fully protected from the interior of the building by a thermal barrier of one-half (1/2) inch gypsum wallboard having a finish rating of not less than 15 minutes or other approved material having an equivalent finish rating. Thermal barriers shall be installed in a manner that they will remain in place for a minimum of 15 minutes under the same test conditions.
3. Foam plastic trim covering not more than ten (10) per cent of the wall or ceiling area may be used provided such trim:
 - (1) has a density of not less than twenty (20) pounds per cubic foot;

(2) has a maximum thickness of one-half (1/2) inch and a maximum width of four (4) inches; and (3) has a flame spread rating no greater than seventy-five (75).

**TABLE 3420-1
INSULATION MATERIAL STANDARDS**

Material or Product	Material Specifications
Mineral Fiber Blanket/Batt	F.S. HH-I-521E, ASTM C665-70
Loose Fill	F.S. HH-I-585B, ASTM C764-75
Mineral Cellular Perlite	F.S. HH-I-574A, ASTM C549-73
Vermiculite	F.S. HH-I-585B, ASTM C516-67
Organic Fiber Cellulose	F.S. HH-I-515C, ASTM C739-77 E84-77
Reflective	F.S. HH-I-1252A
Organic Cellular Polystyrene Board	F.S.HH-I-524B, ASTM C578-69
Urethane Board	F.S. HH-I-530A, ASTM C591-69
Flexible Unicellular	F.S.HH-I-573B, ASTM C534-70
Vapor Barriers	ASTM C755-73

3420.3.3 Roof coverings: Foam plastics may be used as a roof covering if the foam plastic is a part of a Class A, B or C roofing assembly.

That plastic foam which is nearest the interior of the building shall be protected by an approved barrier which need not have a fifteen (15) minute finish rating.

3420.3.4 Coverings over foam plastics: Ordinary roof coverings, other than Class A, B, or C, may be applied over foam plastic when the foam is separated from the interior of the building by plywood sheathing not less than one-half (1/2) inch in thickness with exterior glue, with edges supported by blocking, tongue and groove joints, or other approved type of edge support, or an equivalent material.

3420.3.5 Non-structural foam sheathing: Refer to Section 3404.3.10.

3420.4 Blanket batt insulation 3420.4.1 Labeling: All insulation shall be labeled as required in Article 31.

3420.4.2 Cavities: Fill small cavities between rough framing and door and window heads, jambs, and sills with insulation.

3420.5 Perimeter Insulation: Perimeter insulation for slab on grade construction shall be installed so that the concrete to concrete contact between the foundation wall and the floor slab is broken and the insulation extends downward the thickness of the slab and then extends four (4) feet vertically down from, or four (4) feet horizontally beneath, the floor slab.

SECTION 3421.0 VENTILATION

3421.1 Attic ventilation: Enclosed attics, and enclosed rafter spaces formed where ceilings are applied direct to the underside of roof rafters, shall have cross-ventilation for each separate space by ventilating openings protected against the entrance of rain and snow, sized by the criteria in Sections 3421.1.1 and 3421.1.2.

3421.1.1 With a ceiling vapor barrier installed: Attics with a ceiling vapor barrier must be ventilated with screened openings of at least one (1) square foot of free vent area for each three hundred (300) square feet of ceiling area.

3421.1.2 Without a ceiling vapor barrier installed: Attics without a ceiling vapor barrier installed shall be ventilated with screened openings of at least one (1) square foot of free vent area for each one hundred fifty (150) square feet of ceiling area.

3421.1.3 Eave vents: When eave vents are installed, adequate baffling shall be provided to deflect the incoming air above the surface of the insulation. Baffles shall be installed prior to insulation, and shall be installed over the exterior wall at an angle to provide a two (2) inch minimum clearance under the roof deck for upward flow of ventilation air to the fixed vents in the upper portion of the attic.

3421.1.4 Ridge or gable vent: When eave vents are installed, the ridge or gable vent must be at least three (3) feet above the level of the eave vents.

3421.2 Underfloor space ventilation

3421.2.1 With a ground vapor barrier: Underfloor spaces with an approved vapor barrier installed on the ground surface shall be ventilated with screened openings of one (1) square foot of vent area for each fifteen hundred (1,500) square feet of crawl space. Vents shall be positioned to provide cross ventilation. See Section 3402.9.

SECTION 3422.0 VAPOR BARRIERS

3422.1 Vapor barriers: A vapor barrier of 1.0 perm or less shall be installed on the winter warm side of walls, ceilings and floors enclosing a conditioned space.

3422.2 Seams: When using blanket insulation, all seams and joints shall be butted tight and tears taped or sealed.

Exception: Vapor barriers may be eliminated with adequate ventilation as defined in Section 3421.0.

SECTION 3423.0 U-VALUES OF BUILDING COMPONENTS

3423.1 General: All new construction and additions to existing buildings covered by this section shall conform to the maximum U and R values listed in Table 3423-1 and as specified in this section.

3423.2 Alternates: The stated U_o (or U) value of any one assembly, such as roof/ceiling, wall or floor, may be increased and the U_o (or U) value for other components decreased provided that the overall heat gain or loss for the entire building envelope does not exceed the total resulting from conformance to the stated U_o (or U) values.

SECTION 3424.0 AIR LEAKAGE FOR ALL BUILDINGS

3424.1 General: The requirements of this section shall apply to all buildings and structures and apply to those locations separating outdoor ambient conditions from interior spaces that are heated or mechanically cooled and are not applicable to the separation of interior conditioned spaces from each other.

3424.2 Exterior envelope sealing: Exterior joints around windows and door frames; openings between walls and foundations, between walls and roof and between wall panels; openings at penetrations of utility services through walls, floors and roofs; and all other such openings in the building envelope shall be caulked, gasketed, weatherstripped, or otherwise sealed.

3424.3 Infiltration: All exterior doors and windows shall be designed to limit air leakage into or from the building envelope, and shall have air infiltration rates no

greater than 0.5 cfm per linear foot of operable sash crack for windows, 0.5 cfm per square foot of door area for sliding glass doors and 1.25 for entrance doors, according to the testing procedure of ASTM E283.

Exceptions:

1. Permanently installed storm windows and doors installed over exterior windows and doors shall be accepted when windows and doors have not been tested for infiltration according to Section 3424.3.
2. Fixed glazing is exempt from infiltration testing requirements.
3. Fire doors with a fireresistive rating over one (1) hour, and fire windows are exempt from this section.

**SECTION 3425.0 SYSTEM DESIGN
HEATING COOLING CAPACITY**

3425.1 General: The rated capacity of the heating/cooling system at design conditions shall not be greater than one hundred twenty-five (125) per cent of the design output load calculated in accordance with this Article. Equipment designed for standby purposes is not included in the capacity limitation requirement. The cooling cycles of heat pumps are exempt from this requirement.

3425.2 HVAC equipment performance requirements: HVAC equipment shall meet the requirements stated here and in Article 31.

3425.2.1 Data: The requirements for energy conservation apply to equipment and component performance for heating, ventilating, and air conditioning systems. Where equipment efficiency levels are specified, data furnished by the equipment supplier, or certified under a nationally-recognized certification program or rating procedure, shall be used to satisfy these requirements.

3425.2.2 HVAC-system heating equipment, heat pumps-heating mode: Heat pumps whose energy input is entirely electric shall show a coefficient of performance (COP heating, as defined herein) not less than 2.2 for air source of 47 dB/43WB, 1.2 (17 dB/15WB and 2.2 water source (60 entering).

3425.2.3 Mechanical ventilation: Each mechanical ventilation system (supply and/or exhaust) shall be equipped with a readily accessible means for either shut-off or volume reduction, and shut-off when ventilation is not required.

TABLE 3423-1
MAXIMUM U VALUES AND MINIMUM R VALUES OF WALLS,
ROOF/CEILING, AND FLOORS
FOR ONE AND TWO-FAMILY DWELLINGS

Element	Description	U Value	Total R Value	Notes
Walls	All wall construction containing heated or mechanically cooled space	0.08	12.5	1
	Electric resistance heating	0.05	20.0	1
Foundation Walls including joists	Containing heated or mechanically cooled space	0.08	12.5	
	Containing unheated space	0.08	12.5	4
Roof/Ceiling Assy	All roof construction containing heated or mechanically cooled space	0.033	30.0	
Windows	All construction enclosing heated or mechanically cooled space	0.65	1.54	2
	Electric resistance heating	0.40	2.50	6,7
Doors	All construction enclosing heated or mechanically cooled space	0.40	2.50	
Floors	Floor sections over areas exposed to outside air or unheated space	0.05	20.0	3
	Slab on grade beneath conditioned space		10.0	5

Note 1: These values may be used when the doors and windows do not exceed fifteen (15) of the gross exterior wall area. When doors and windows exceed fifteen (15) percent of the gross wall area, see Section 2009.1, Item 2.

Note 2: Double glazed primary windows or single glazed primary windows with storm windows will satisfy the required U value of zero point sixty-five (0.65).

Note 3: Insulation may be omitted from floors over unheated areas when foundation walls are provided with a U value of zero point zero eight (0.08).

Note 4: The U value requirement of zero point zero eight (0.08) for foundation walls may be omitted when floors over unheated spaces are provided with a U value of zero point zero five (0.05).

Note 5: R value for perimeter insulation (See Section 3420.5).

Note 6: When doors and windows do not exceed fifteen (15) percent of the gross exterior wall area, this value may be used. When doors and windows do not exceed ten (10) percent of the gross exterior wall area, windows having a U value of 0.65 (R value of 1.54) may be used. When windows and doors exceed fifteen (15) percent of the gross exterior wall, see Section 2009.1, item 2.

Note 7: Double glazed primary windows with storm windows or most triple glazed primary windows or double glazed low emissivity primary windows will satisfy the required U value of zero point forty (0.40).

3425.2.4 HVAC-system equipment, electrically operated cooling mode: HVAC-system equipment as listed below whose energy input in the cooling mode is entirely electric, shall show a Coefficient of Performance (COP) cooling as defined herein not less than 1.8 for under 65,000 Btu/hr., 2.0 for over 65,000 Btu/hr.

SECTION 3426.0 CONTROLS

3426.1 Temperature control: Each HVAC system shall be provided with at least one (1) thermostat for the regulation of temperature. Each thermostat shall be capable of being set as follows:

1. Where used to control heating only, 55-75° F.
2. Where used to control cooling only, 70-85° F.
3. Where used to control both heating and cooling it shall be capable of being set from 55-85° F. and shall be capable of operating the system heating and cooling in sequence. It shall be adjustable to provide a temperature range of up to 10° F. between full heating and full cooling.

3426.2 Humidity control: If an HVAC system is equipped with a means for adding moisture to maintain specific selected relative humidities in spaces or zones, a humidistat shall be provided. This device shall be capable of being set to prevent new energy from being used to produce space relative humidity above thirty (30) per cent relative humidity when moisture is added, or below sixty (60) per cent relative humidity when moisture is removed.

3426.3 Zoning for temperature control: At least one (1) thermostat for regulation of space temperature shall be provided for each separate HVAC system. In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each zone or floor. Register dampers and hot water radiator hand dampers will suffice.

3426.4 Control setback and shut-off

3426.4.1 General: The thermostat required in Section 3426.3 or an alternate means such as a switch or clock, shall provide a readily accessible, manual or automatic means for reducing the energy required for heating and cooling during periods of nonuse or reduced need, such as, but not limited to, unoccupied periods and sleeping hours.

3426.4.2 Energy expended: Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

SECTION 3427.0 BALANCING

3427.1 General: The HVAC system design shall provide means for balancing the air and water systems such as but not limited to dampers, temperature and pressure test connections, flow measuring stations or meters, and balancing valves. The HVAC systems shall be field balanced to achieve conditions stated in the plans and specifications.

SECTION 3428.0 DUCT INSULATION

3428.1 General: When low pressure supply air ducts are located outside of the conditioned space (except return air plenums), all transverse joints shall be sealed using mastic or mastic plus tape. For fibrous glass duct work, pressure sensitive tape may be used. For duct construction refer to Section 3415.0, Ducts.

3428.2 Insulation: All duct systems, or portions thereof, exposed to nonconditioned spaces shall be insulated to provide a thermal resistance, excluding film resistances, of $R = (t_i - t_o)/15 \text{ (hr) (sq. ft.) (F)/Btu}$, where $(t_i - t_o)$ is the temperature differential (absolute value) between the air in the duct and the surrounding air.

Exceptions: Duct insulation, except when needed to prevent condensation, is not required in any of the following cases:

1. In basements and cellars with insulated walls.
2. When the heat gain or loss of the ducts, without insulation, will not increase the energy requirements of the building.
3. Exhaust air ducts.

Where required to prevent condensation, insulation with vapor barriers shall be installed in addition to insulation required above.

SECTION 3429.0 PIPE INSULATION

3429.1 General: All hot water piping, or portions thereof, exposed to nonconditioned space shall be insulated to provide a thermal resistance in the range of R equals 4.0 to 4.6. This is typically one (1) inch of pipe insulation.

REFERENCE STANDARDS - ARTICLE 34

RS-34-1 Shower Compartment Finish

Glazed Ceramic Wall Tile Installed with Portland Cement Mortar ANSI A108.1,1967 - American National Standards Institute (ANSI) A108.1 - 1967

Ceramic Tile Installed with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy-ANSI A108.6, 1969

Dry-Set Portland Cement Mortar (for installation of ceramic tile) - ANSI A118.1,1967

Organic Adhesives for Installation of Ceramic Tile-ANSI A136.1,1967 (Type I only in Shower Compartments) Standard Specification for Ceramic Tile-ANSIA137.1, 1967

Ceramic Tile Installed with Dry-Set Portland Cement Mortar - ANSI A108.5,1967

Ceramic Mosaic Tile Installed with Portland Cement Mortar - ANSI A108.2,1967

Ceramic Tile Installed with Water-Resistant Organic Adhesives - ANSI A108.4,1968

RS-34-2 Glazing Materials

Glass. Federal Specification DD-G 451c

Safety Glazing Materials - ANSI Z97.1,1972

RS-34-3 Foundations

Building Brick and Facing Brick. (Made from Clay or Shale). Standard Specifications C62-58 and C346 of the American Society for Testing and Materials(ASTM).

Sand-Lime Building Brick. Standard Specification C73-51 of ASTM.

Concrete Building Brick. Standard Specification C55-55 of ASTM.

Hollow Load-Bearing Concrete Masonry Units. Standard Specification C90-59 of ASTM.

Solid Load-Bearing Concrete Masonry Units. Standard Specification C145-59 of ASTM.

Method of Test for Concrete Masonry Units. Standard Specification C140-63T of ASTM.

Structural Clay Load-Bearing Wall Tile. Standard Specifications C34-62 and C112-60 of ASTM.

Cast Stone. Specification ACI 704-44 of the American Concrete Institute.

Cold-Drawn Steel Wire for Concrete Reinforcement. Standard Specification A82 of ASTM.

Cement, Masonry. Standard Specification C91-67 of ASTM.

Quicklime for Structural Purposes. Standard Specification C5-59 of ASTM.

Hydrated Lime for Masonry Purposes. Standard Specification C207-49 of ASTM.

Processed Pulverized Quicklime. Standard Specification C51-47 of ASTM.

Mortar for Masonry Other than Gypsum. Specifications C161-44T and C270-59T of ASTM.

Aggregate for Masonry Mortar. Specification C144-52T of ASTM.

Aggregates for Grout. Standard Specification C404 of ASTM.

Sampling and Testing Brick. Standard Specification C67-60 of ASTM.

Portland Cement. Standard Specifications C150-62 and C175-66 of ASTM.

Portland Blast Furnace Slag Cement. Specification C205-62T of ASTM.

Portland Pozzolan Cement. Specification C340-62T of ASTM.

Concrete Aggregates. Specification C33-61T of ASTM. Concrete Proportions. ACI 613-54 and 613-59 of the American Concrete Institute.

Concrete Reinforcement. Specifications A615-68, A616-68, A617-68 and A82-66 of ASTM.

Steel Bar Mats. Standard Specifications A184-65, A615-68, A616-68 and A617-68 of ASTM.

Welded Steel Wire Fabric. Specification A185-61T of ASTM.

Admixtures for Concrete. Standard Specification C494-62T of ASTM.

Concrete Tests. Standard Specifications C31-62, C39-61, C42-61 and C192-62 of ASTM.

Splitting Tensile Strength. Specification C496-62T of ASTM.

Ready-Mixed Concrete. Standard Specification C94-62 of ASTM.

Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction. AWS D12. 1-61 of the American Welding Society.

Hollow Brick. (Hollow Masonry Units Made from Clay or Shale) Standard Specification C652-70 of ASTM.

Building Brick and Facing Brick. (made from Clay or Shale) Standard Specifications C62-69 and C216 of ASTM.

Mortar for Masonry Other than Gypsum. Standard Specification C270-68 of ASTM.

Aggregate for Masonry Mortar. Standard Specification C144-70 of ASTM.

Aggregate for Masonry Grout. Standard Specification C404-70 of ASTM.

Methods of Sampling and Testing Brick. Standard Specification C67-66 of ASTM.

Applicable Standards or Publications in Referenced Standard RS-21-5.

~~RS-21-4~~ Preservatives

American Wood Preserves Bureau (AWPB) Standards CP-22, CP-33, CP-44, CP-55, and CP-77 for pressure treated poles.

AWPB Standards LP-2, LP-3, LP-4, LP-5 and LP-7 for pressure treated softwood lumber used above ground.

AWPB Standards LP-22, LP-33, LP-44, LP-55 and LP-77 for pressure treated softwood lumber used in contact with the ground.

RS-21-5 Wall Construction

Applicable Standards or Publications in Reference Standard RS-21-3.

Classification, Definition and Methods of Grading for all Species of Lumber. Standard D245-70 of ASTM; American Softwood Lumber Standards PS 20-70 of the U. S. Department of Commerce.

Design for Permanence, Wood Construction DATA #6 National Forest Products Association (NFPA).

Eastern Pine, Jack Pine, Eastern Spruce, Balsam Fir, Eastern Hemlock and Tamarack. Grading Rules, Northern Hardwood and Pine Manufacturers Association (September 1, 1970).

House Framing. Manual for National Forest Products Association Wood Construction DATA #1.

National Design Specification for Stress-Grade Lumber and Its Fastenings. National Forest Products Association 1977 with Supplement.

Northeastern Lumber. Standard Grading Rules, Northeastern Lumber Manufacturers Association (April, 1977).

Pine, Southern. Grading Rules, Southern Pine Inspection Bureau (1977).

Redwood. Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service (December, 1976).

Softwood Plywood. Construction and Industrial Product Standard PS 1-74 (August, 1974) of the U. S. Department of Commerce, Bureau of Standards.

Design Specifications for Light Metal Plate Connected Wood Trusses. Truss Plate Institute (TPI) 197.

West Coast Lumber. Standard Grading Rules, West Coast Lumber Inspection Bureau.

Western Lumber. Standard Grading Rules, Western Wood Products Association (1977).

Poles Building Design. American Wood Preservers Institute (November, 1972).

Plank-and-Beam Framing. Wood Construction Data No. 4, National Forest Products Association.

Fiberboard Nail-Base Sheathing and Structural Insulating Board. Standard Specifications D2277-66 and C208-66 of ASTM.

Particleboard. U. S. Department of Commerce-Commercial Standard CS 236-66.

Material Specifications for Structural Steel. Standard Specifications A27, A36, A53, A148, A167, A235, A237, A242, A245, A252, A303, A307, A325, A354, A374, A375, A412, A440, A441, A446, A449, A490, A500, A501, A502, A514, A529, A570, A572 and A588 of ASTM.

Standard Specification for Structural Glued Laminated Timber Using "E" Rated and Visually Graded Lumber of Douglas Fir, Southern Pine, Hem-Fir and Lodepole Pine, American Institute of Timber Construction.

Canadian Lumber. Standard Grading Rules for Canadian Lumber, U. S. Edition (July 1, 1973). Approved by the American Lumber Standards Board of Review.

Specifications for Aluminum Structures of the Aluminum Association.

Connectors other than those specified in Section 3402.0 of this Code may be used in accordance with Table RS-21-6.

Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, American Institute of Steel Construction, 1969 Edition and Supplements Nos. 1 and 2.

RS-21-6 Wall Covering

Applicable Standards and Publications in Reference Standards RS-21-2 and RS-21-5.

Aluminum Structures. Specifications for, by the Aluminum Association (November, 1967).

Plaster Liquid Bonding Agents. U. S. Government Military Specification MIL-B-19235 (Docks) (1965), and Standards Specifications of the California Lathing and Plastering Contractors Association (1965), and Recommendations of the Gypsum Association.

Adhesives for Fastening Gypsum Wallboard to Wood Framing. Specification C557-67 of ASTM.

Perlite, Vermiculite and Sand Aggregates for Gypsum and Portland Cement Plaster. Standards Specification C35-70 of ASTM.

Metal Lath, Wire Lath, Wire Fabric Lath and Metal Accessories. Approval Standard A42.4-1967 of ANSI.

Gypsum Wallboard Tape and Joint Compound. Standard Specifications C475-70 and C474-67 of ASTM.

Gypsum Backing Board. Standard Specification C442-67 of ASTM.

Gypsum Lath. Standard Specification C37-69 of ASTM.

Lime. Standard Specifications C206-68 and C6-49 of ASTM.

Gypsum Plasters. Standard Specification C28-68 of ASTM.

Gypsum Sheathing Board. Standards Specification C79-67 of ASTM.

Gypsum Veneer Plaster. Standards Specification C587-68 of ASTM.

Gypsum Veneer Base. Standard Specification C588-68 of ASTM.

Gypsum Wallboard. Standard Specification C36-70 of ASTM.

Keene's Cement. Standard Specification C61-64 of ASTM.

Gypsum Molding Plaster. Standard Specification C59-50 of ASTM.

Gypsum Plastering. Standard Specification A42.1-1964 of ANSI.

Interior Lathing and Furring. Standard Specifications 2.4-1967 of ASTM.

Application and Finishing of Gypsum Wallboard. Standard Specifications A97.1-65 of ANSI.

Surface Burning Characteristics of Building Materials. Standard Method of Test E84-70 of ASTM.

RS-21-7 Floors

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-5.

Maximum Spans for Joists and Rafters. Technical Bulletin 2, of NFoPA.

Canadian Dimension Lumber, Revised edition 1972, Canadian Wood Council.

RS-21-8 Roof-Ceiling

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-6.

Maximum Spans for Joists and Rafters. Technical Bulletin 2, of NFoPA.

Canadian Dimension Lumber. 1971, Canadian Wood Council.

RS-21-9 Roof Coverings

Aluminum Sheet Metal Work in Building Construction by the Aluminum Association (October, 1967).

Composition Roofing. Standard Specification 55-A (May, 1967) Underwriters' Laboratories, Inc.

Roofing Asphalt. Standard Specification D312-44 of ASTM.

Composition Roofing. Standard Specification 55-B. (April, 1962), Underwriters' Laboratories, Inc.

Sheet Metals. Standard Specifications A245-62aT, A361-63T and B209-70 of ASTM.

Corrosion-Resistant Metals. Standard Specifications A219-58, A239-41 and B209-70 of ASTM.

Composition Roofing Testing. Standard Specification 790 (September, 1958), Underwriters' Laboratories, Inc.

Hand-Split Shakes. Grading and Packing Rules, Hand-Split Red Cedar Shakes 1971, Red Cedar Shingle and Hand-Split Shake Bureau.

Asbestos-Cement Shingles. Standard Specification C222-60 of ASTM.

Slate Shingles. Standard Specification C406-57T of ASTM.

Wood Shingles. Commercial Standard CS31-52, U. S. Department of Commerce, National Bureau of Standards. Grading and Packing Rules for Red Cedar Shingles (1971) Red Cedar Shingles and Handsplit Shake Bureau.

Wire. Standard Specifications B134-62, B211-63, and B250-62 of ASTM.

RS-21-10 Chimney and Fireplace

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-5.

RS-21-11 Mechanical Materials

Galvanized Sheet Metals. Standard Specification A525-64T of ASTM.

Tank Piping and Valves for Oil Burning Appliances. Pamphlet No. 31, June, 1965, of the NFiPA.

Nonmetallic Ducts. Standard No. 181 of the UL.

Refrigeration. Standard No. B9.1-1964 of the ANSI.

Wrought Steel and Wrought Iron Pipe. Standard B36.10-1959 of the ANSI.

Seamless Copper Tube, Copper Pipe and Red Brass Pipe. Standard Specifications B42-62, B43-62, B68-60, B88-66, B251-66 and B280-66 of ASTM.

Compression (neoprene) Gaskets (including hubless piping system) for Cast Iron Piping and Fittings in Condensate Drain Lines. Standard Specification C564-70 of ASTM, or CISPI Standards HSN-72 and 301-72.

Stainless Steel Coupling (hubless piping system) for Cast Iron Piping and Fittings in Condensate Drain Lines. CISPI Standard 301-72.

Load Calculation for Residential Winter and Summer Air-Conditioning. Manual J., Third Edition, of NISC.

Installation of Gas Appliances and Gas Piping. Standard No. 54, 1969 of the NFiPA.

Installation of Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises. Standard No. 54-A, 1969 of the NFiPA.

Chimneys, Fireplaces and Venting Systems. Standard No. 211, 1970 of the NFIPA.

Installation of Residence-Type Warm Air Heating and Air Conditioning Systems. Standard No. 90-B, 1971 of the NFIPA.

RS-21-12 Mechanical Equipment

Applicable Standards or Publications in Reference Standard RS-21-11.

Mechanical Ventilation. Testing and Rating Procedures of Home Ventilating Institute.

RS-21-13 Smoke/Heat Detectors

NFiPA Standard No. 101 of 1971-1972

NFiPA Standards No. 74 of 1971-1972

RS-21-14 Solid-Fuel Appliances

Factory-Built Chimneys. Standard No. 103, 1978 of the UL.

Factory-Built Fireplaces. Standard No. 127, 1972 of the UL.

Free-Standing Fireplaces. Standard No. 737, 1978 of the ANSI/UL.

Free-Standing Room Heaters. Standard No. 1482, 1979 of the UL.

Solid and Solid/Liquid Fuel Burning Central Heating Boilers and Warm Air Furnaces. Standard No. B366-M, 1979 of the Canadian Standards Association (CSA).

Interior Lathing and Furring.

Standard Specifications 2.4-1967 of ASTM.

Application and Finishing of Gypsum Wallboard.

Standard Specifications A97.1-65 of ANSI.

Surface Burning Characteristics of Building Materials.

Standard Method of Test E-84-70 of ASTM.

Design and Application Manual for Exterior and Interior Walls.

Cedar Shake and Shingle Bureau.

RS-21-7 Floors

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-5.

Maximum Spans for Joists and Rafters. Technical Bulletin 2, of NFoPA.

Canadian Dimension Lumber, Revised edition 1972, Canadian Wood Council.

RS-21-8 Roof-Ceiling

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-6.

Maximum Spans for Joists and Rafters. Technical Bulletin 2, of NFoPA.

Canadian Dimension Lumber. 1971, Canadian Wood Council.

RS-21-9 Roof Coverings

Aluminum Sheet Metal Work in Building Construction by the Aluminum Association (October, 1967).

Composition Roofing.

Standard Specification 55-A (May, 1967) Underwriters' Laboratories, Inc.

Roofing Asphalt. Standard Specification D312-44 of ASTM.

Composition Roofing. Standard Specification 55-B.

(April, 1962), Underwriters' Laboratories, Inc.

Sheet Metals. Standard Specifications A245-62aT, A361-63T and B209-70 of ASTM.

Corrosion-Resistant Metals.

Standard Specifications A219-58, A239-41 and B209-70 of ASTM.

Composition Roofing Testing.

Standard Specification 790 (September, 1958), Underwriters' Laboratories, Inc.

Wood Shakes. Grading Rules for Certi-Sawn Taper Sawn Red Cedar Shakes - 1981, and Grading Rules for Certi-Split Red Cedar Shakes - 1985. Cedar Shake and Shingle Bureau.

Asbestos-Cement Shingles. Standard Specification C222-60 of ASTM.

Slate Shingles. Standard Specification C406-57T of ASTM.

Wood Shingles. Grading Rules for Certi-Grade Shingles - 1984. Cedar Shake and Shingle Bureau.

Wire. Standard Specifications B134-62, B211-63, and B250-62 of ASTM.

Design and Application Manual for New Roof Construction. Cedar Shake and Shingle Bureau.

RS-21-10 Chimney and Fireplace

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-5.

RS-21-11 Mechanical Materials

Galvanized Sheet Metals. Standard Specification A525-64T of ASTM.

Tank Piping and Valves for Oil Burning Appliances. Pamphlet No. 31, June, 1965, of the NFIPA.

Nonmetallic Ducts. Standard No. 181 of the UL.

Refrigeration. Standard No. B9.1-1964 of the ANSI.

Wrought Steel and Wrought Iron Pipe. Standard B36.10-1959 of the ANSI.

Seamless Cooper Tube, Copper Pipe and Red Brass Pipe. Standard Specifications B42-62, B43-62, B68-60, B88-66, B251-66, and B280-66 of ASTM.

Compression (neoprene) Gaskets (including hubless piping system) for Cast Iron Piping and Fittings in Condensate Drain Lines. Standard Specification C564-70 of ASTM, or CISPI Standards HSN-72 and 301-72.

Stainless Steel Coupling (hubless piping system) for Cast Iron Piping and Fittings in Condensation Drain Lines. CISPI Standard 301-72.

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APPENDIX A

REFERENCED STANDARDS

Part I

The following is a listing of the standards referenced in this code, the effective date of the standard, the promulgating agency of the standard and the section(s) of this code that refer to the standard.

AA

Aluminum Association
900 19th Street, N.W.
Suite 300
Washington, D.C. 20006

Standard reference	Title	Referenced in code Section number
ASM 35-80	Aluminum Sheet Metal Work in Building Construction - Specifications for	1901.1
SAS 30-86	Aluminum Structures - Specification for	1901.1

AAMA

American Architectural Manufactures Association
2700 River Road, Suite 118
Des Plaines, Illinois 60018

1402-86	Standard Specifications for Aluminum Siding, Soffit and Fascia	Table 2104.1
1503.1-80	Test Methods of Thermal Transmittance of Windows, Doors and Glazed Wall Sections	3108.2

AASHTO

American Association of State Highway and
Transportation Officials
444 North Capitol Street, N.W.
Suite 225
Washington, D.C. 20001

HB-13-83	Highway Bridges, Standard Specifications for 1984, 1985, and 1986 Supplements	Table 1106
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ACI

American Concrete Institute
P.O. Box 19150
Detroit, Michigan 48219

318-83	Reinforced Concrete - Building Code Requirements for - 1986 Revision	1113.5.1, 1113.5.1.2, 1113.5.1.4, 1113.5.5.5, 1209.2, 1209.6, 1410.1, 1411.1, 1599.1, 1500.2, 1501.1, Table 1501.1, 1502.1, 1502.2, 1502.4.2, 1502.5.1, 1502.6.1, 1502.7, 1503.1, 1503.2, 1503.2.1, 1503.3.3, 1503.3.4, 1503.4.1, 1503.4.4, 1504.3.2, 1504.6.2, 1506.1, 1506.3.1, 1506.5, 1506.6.2, 1506.6.5
318.1-83	Structural Plain Concrete - Building Code Requirements for	1500.2, 1500.7
506.2-77	Shotcrete, Specification for Materials, Proportioning, and Application of - 1983 Revision	1508.9
531-79	Concrete Masonry Structures - Building Code Requirements for - 1983 Revisions	908.3, 1410.1, 1411.1, 1412.1, 1417.3, 1418.1, 1422.3, 1804.1

AHA

American Hardboard Association
520 N. Hicks Road
Palatine, Illinois 60067

A135.6-84	Hardboard Siding	1709.7, 2104.1.2
A135.4	. . . . .	2104.1.1
A194.1-85	Cellulosic Fiber Board	1709.7

AISC

American Institute of Steel Construction, Inc.
400 N. Michigan Avenue
Chicago, Illinois 60611

AISC-78	Design, Fabrication and Erection of Structural Steel for Buildings - Specification for the - Supplement #1 - Effective Jan. 1, 1989	1801.1
AISC -LF-86	Load and Resistance Factor Design Specifications for Structural Steel Buildings	1801.1

AISI

American Iron and Steel Institute
1000 Sixteenth Street, N.W.
Washington, D.C. 20036

AISI-73	Structural Applications of Steel Cables for Buildings - Manual for	1807.2
AISI-74	Design of Cold Formed Stainless Steel Structural Members - Specification for	1802.1
AISI-80	Designing Fire Protection for Steel Columns . . .	903.1.1
AISI-81	Designing Fire Protection for Steel Trusses	903.1.1
AISI-84	Designing Fire Protection for Steel Beams	903.1.1
AISI-86	Design of Cold Formed Stainless Steel Structural Members - Specification for	1802.1
----	Criteria for Structural Applications of Steel Cables for Buildings	1807.2

AITC

American Institute of Timber Construction
333 W. Hampden Avenue
Englewood, Colorado 80110

108-86	Heavy Timber Construction - Standard for	1702.1
109-84	Structural Glued Laminated Timber - Treating Specification for	1708.2
112-81	Tongue and Groove Heavy Timber Roof Decking - Standard for	1702.1
117-85	Structural Glue Laminated Timber of Softwood Species - Design Specification for - Addendum 1985	1702.1
A190.1-83	Hardwood Glued Laminated Timber - Standard Specification for	1702.1
----	Structural Glued Laminated Timber	1702.1
----	Timber Construction Manual	1113.5.4.1, 1113.5.4.2

ANSI

American National Standards Institute, Inc.
1430 Broadway
New York, New York 10018

A10.5-81	Material Hoists - Safety Requirements for	2614.5
A12.1-73	Floor and Wall Openings, Railings, and Toeboards Safety Requirements for	3013.4
A13.1-81	Scheme for the Identification of Piping Systems .	603.5.3
A58.1-82	Loads, Minimum Design in Building and other Structures - Building Code Requirements for . .	623.4, 1104.1, 1112.12 1112.12.2,
A108.4-85	Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives - Installation of	1409.6
A108.5-85	Tile, Ceramic, Installed with Dry Set Portland Cement Mortar	1409.5.1, 1409.5.2
A108.6-85	Tile, Ceramic, Installed with Grouting Epoxy . . .	1409.7
A108.7-85	Tile, Electrically Conductive Ceramic, Installed with Conductive Dry Set Portland Cement Mortar .	1409.5.1
A117.1-86	Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped People - Specification for	512.4, 2607.4
A118.1-85	Dry Set Portland Cement Mortar - (For Ceramic Tile)	1409.5.1

ANSI

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A118.2-85	Conductive Dry Set Portland Cement Mortar, Standard Specification for (Ceramic Tile)	1409.5.1
A118.3-85	Epoxy, Chemical Resistant, Water Cleanable Tile Setting and Grouting - Standard Specification for	1409.7
A118.4-85	Latex Portland Cement Mortar- Standard Specification for (Ceramic Tile)	1409.5.2
A136.1-85	Organic Adhesives for Installation of Ceramic Tile	1409.6
A208.1-79	Mat Formed Wood Particle Board	1711.1, 1711.2
B153.1-81	Construction, Care and Use of Automobile Lifts Safety Requirements for	2615.1
Z49.1-83	Safety in Welding and Cutting	3018.5
Z97.1-84	Safety Glazing Material Used in Buildings - Performance Specifications and Methods of Test for	2203.1, 2206.1
A119.1-74	. . . . .	3300.3
101-85	. . . . .	3107.5.1, 3107.5.2
2-80	. . . . .	3107.5.1

APA

American Plywood Association
7011 S. 19th Street
Tacoma, Washington 98466

E30-86	Design/Construction Guide Residential and Commercial	1710.1
E315C-86	Plywood Diaphragms, Report No. 138	1701.1, 1708.3
H815-85	Design and Fabrication of All-Plywood Beams . .	1708.3
S811-85	Plywood Curved Panels - Design and Fabrication of	1707.1, 1708.3
S812-86	Plywood Lumber Beams - Design and Fabrication of	1707.1, 1708.3
U813-84	Plywood Stressed-Skined Panels - Design and Farbrication of	1707.1, 1708.3
U814-82	Plywood Sandwich Panels - Design and Fabrication of	1707.1, 1708.3
Y510-86	Plywood Design Specification	1710.1

ARI

Air-Conditioning & Refrigeration Institute
1501 Wilson Boulevard
Arlington, VA 22209

210-84	.....	Table 3111.4, 3111.5
210-81	.....	Table 3111.4, 3111.5
240-81	.....	Table 3111.4, 3111.5
240-84	.....	Table 3111.4, 3111.5
365-85	.....	Table 3111.6
550-83	.....	Table 3111.6
590-81	.....	Table 3111.6

ASHRAE

American Society of Heating,
Refrigerating and Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, Georgia 30329

55-81	.....	3105.4.2
AHB-82	Applications Handbook-1982 Edition	3108.5
AHB-85	Applications Handbook-1985 Fundamental Volume	3108.2, 3114.3.2.2, 3114.4.3.2

ASME

American Society of Mechanical Engineers
United Engineering Center
345 East 47th Street
New York, New York 10017

ASME-86	Boiler and Pressure Vessel Code, Section VIII, Division 1&2 - Summer 86 Addenda	2614.4
A17.1-84	Elevator, Dumbwaiters, and Moving Walks Safety Code for - 1985 Supplement	2600.2, 2603.3.2 2604.4, 2607.2
B31.3-84	Power Piping	603.5

ASTM

American Society for Testing Materials
1916 Race Street
Philadelphia, Pennsylvania 19103

A48-83	Gray Iron Castings - Specifications for	1806.1
A256-82	Cast Iron - Compression Testing of	1806.1
A706-84	Low-Alloy Steel Deformed Bars for Concrete Reinforcement - Specifications for . .	1502.5.2
C5-84	Quicklime for Structural Purposes - Specifications for	Table 1601
C28-86	Gypsum Plasters - Specifications for	Table 1601
C31-84	Making and Curing Concrete Test Specimens in the Field - Practice for	1503.4.2, 1503.4.3
C33-86	Concrete Aggregates - Specifications for	1502.3, Table 1503.1
C34-84	Structural Clay Loadbearing Wall Tile Specifications for	1403.1
C35-81	Inorganic Aggregates for Use in Gypsum Plaster - Specifications for	Table 1601
C36-85	Gypsum Wallboard - Specifications for	Table 1603
C37-84	Gypsum Lath - Specifications for	Table 1601
C39-84	Compressive Strength of Cylindrical Concrete Specimens - Method for	1503.4.2
C56-86	Structural Clay Nonloadbearing Tile - Specifications for	1403.1
C59-83	Gypsum Casting and Molding Plaster Specifications for	Table 1601
C61-81	Gypsum Keene's Cement - Specifications for . . .	Table 1601
C62-85	Building Brick (Solid Masonry Units made from from Clay or Shale) - Specifications for	1402.1
C64-85	Refractories for Incinerators and Boilers Specifications for	2402.2
C67-86	Brick and Structural Clay Tile - Sampling and Testing	1410.2
C73-85	Calcium Silicate Face Brick (Sand and Lime) - Specifications for	1402.1
C79-84	Gypsum Sheathing Board - Specifications for . . .	Table 1603
C94-86a	Ready-Mix Concrete - Specifications for	1504.3.1
C105-81	Ground Fire Clay as a Refractory Mortar for Laying Up Fireclay Brick - Specifications for . .	2402.2
C126-84	Ceramic Glazed Structural Clay Tile, Facing Brick and Solid Masonry Units - Specifications for	1404.1, 1402.1

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C144-84	Aggregate for Masonry Mortar - Specifications for	1409.2.1
C150-86	Portland Cement - Standard Specification for . . .	1502.2, 1503.2.1, 1503.2.2, Table 1601
C172-82	Sampling Freshly Mixed Concrete - Method of . .	1503.4.2
C177-76	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate	3108.2
C206-84	Finishing Hydrated Lime - Specification for . . .	Table 1601
C208-82	Insulating Board (Cellulosic Fiber) Structural and Decorative - Specifications for . .	1709.1, Table 3106
C212-86	Structural Clay Facing Tile - Specification for . .	1403.1
C216-86	Facing Brick (Solid Masonry Units Made from Clay or Shale) - Specification	1402.1
C231-82	Air Content of Freshly Mixed Concrete by the Pressure Method - Test Method for	1503.3.1
C236-80	Standard Test Method for Steady State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box	3108.2
C260-86	Air-Entraining Admixtures for Concrete - Specification for	1502.6.2
C270-86b	Mortar for Unit Masonry - Specification for . . .	1409.1, 1409.2.1
C330-82	Lightweight Aggregates for Structural Concrete - Specification for	1502.3
C335-79	Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulations	3110.12.1
C404-85	Aggregates for Masonry Grout - Specification for	1409.2.2
C474-85	Joint Treatment Materials for Gypsum Wallboard Construction - Standard Methods of Testing . .	Table 1603
C475-81	Joint Treatment Materials for Gypsum Wallboard Construction - Standard Methods of Testing . .	Table 1603
C476-83	Grout for Masonry - Specification for	1409.1
C494-86	Chemical Admixtures for Concrete - Specification for	1502.6.2
C514-84	Nails for the Application of Gypsum Wallboard - Standard Specification for	Table 1603
C516-80	Vermiculite Loose Fill Thermal Insulation Standard Specification for	Table 3106
C532-79	Structural Insulating Formboard (Cellulosic Fiber) - Specification for	1709.1

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C549-81	Perlite Loose Fill Insulation Standard Specification for	Table 3106
C587-83	Gypsum Veneer Plaster - Specification for	Table 1601
C588-84	Gypsum Base for Veneer Plasters - Specifications for	Table 1601
C595-85	Blended Hydraulic Cements - Specification for	1503.2.2
C618-85	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete - Specification for	1502.6.3
C630-85	Water Resistant Gypsum Backing Board - Specification for	Table 1603, 1603.4
C631-81	Bonding Compounds for Interior Plastering - Standard Specification for	Table 1601
C645-83	Non-Load (Axis) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board - Standard Specification for	Table 1601, Table 1603
C652-85A	Hollow Brick (Hollow Masonry Units Made from Clay or Shale) - Specification for	1402.1
C685-86A	Concrete Made by Volumetric Batching and Continuous Mixing - Specification for	1504.3.1
C754-82	Steel Framing Members to Receive Screw- Attached Gypsum Wallboard, Backing Board or Water-Resistant Backing Board - Standard Specification for Installation of	Table 1604
C841-85	Installation of Interior Lathing and Furring - Specification for	Table 1604
C842-85	Application of Interior Gypsum Plaster - Specification for	Table 1604
C843-85	Application of Gypsum Veneer Plaster - Specification for	Table 1604
C844-85	Application of Gypsum Base to Receive Gypsum Veneer Plaster - Specification for	Table 1604
C847-83	Metal Lath - Specification for	Table 1601
C887-84	Surface Bonding Mortar - Specification for Packaged, Dry, Combined Materials for	1422.2
C897-83	Aggregate for Job-Mixed Portland Cement-Based Plasters - Standard Specification for	Table 1601

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C926-86	Portland Cement Based-Plaster - Specification for Application of	1602.3
C932-85	Surface-Applied Bonding Agents for Exterior Plastering - Standard Specification for	Table 1601
C933-85	Welded Wire Lath - Standard Specification for	Table 1601
C946-84	Dry-stacked, Surface-Bonded Walls - Practice for Construction of	1422.2, 1422.4
C954-86	Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in Thickness - Standard Specification for	Table 1601, 1603
C955-86	Load Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging for Screw Application of Gypsum and Metal Plaster Bases - Standard Specification for	Table 1601
C976-82	Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box	3108.2
C1002-83	Specification for Drill Screws for the Application of Gypsum Board	Table 1601, Table 1603
C1007-83	Installation of Load Bearing (Transverse and Axial) Steel Studs Accessories - Standard Specification for	Table 1604
D25-86	Round Timber Piles - Specification for	1219.2
D56-82	Flash Point by Tag Closed Tester - Test for	Table 306.2
D92-85	Flash and Fire Points by Cleveland Open Cup - Method of Test for	Table 306.2
D93-85	Flash Point by Pensky-Martens Closed Tester - Method of Test for	Table 306.2
D568-85	Rate of Burning and/or Extent and Time of Burning of Flexible Plastics in a Vertical Position, Test Method for	2907.4.2
D632-81	Rating of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position - Test Method for	2000.2, 2001.1
D635-81	Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position - Standard Test Method for	2002.2, 2001.1

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D1143-81	Piles under Axial Compressive Load - Testing Ignition Properties of Plastics - Test Method for	1214.4.2, 1214.4.3
D1557-78	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb Rammer and 18-in. Drop - Standard Test Method for . .	1201.3.2
D2277-80	Fiberboard Nail Base Sheathing - Specification for	1709.1
D2843-77	Density of Smoke from the Burning or Decomposition of Plastics - Test Method for . .	2000.2, 2001.1
D2898-86	Accelerated Weathering of Fire-Retardant Tested Wood for Fire Testing	903.5.2
D3201-86	Fire-Retardant Wood and Wood-Base Products - Test Method for Hygroscopic Properties of . . .	903.5.2
D3679-86	Rigid Poly (Vinyl Chloride) 9PVC0 Siding - Specification for	Table 2104.1 (Notes)
D3689-83	Individual Piles under Static Axial Tensile Load - Testing	1214.7.2
D3966-81	Piles Under Lateral Loads - Standard Method of Testing	1214.6.2
E72-80	Strength Tests of Panels for Building Construction - Conducting	1418.2, 1419.2, 1704.3
E84-84	Surface Burning Characteristics of Building Materials - Test Method for	637.11, 903.4.1.2, 903.5.1, 904.2, 922.3, 922.5.3, 928.2, 928.3, 929.2.1, 929.2.2, 2000.2
E90-85	Airborne Sound Transmission Loss of Building Partitions - Laboratory Measurements of	714.2
E108-83	Fire Tests of Roof Coverings	2204.6.1, 204.6.2, 2301.1
E119-83	Fire Test of Building Construction and Materials Methods of	903.1.1, 2002.2
E136-82	Behavior of Materials in Vertical Tube Furnace at 750° C. - Standard Test Method for	903.4.1.1
- E152-81A	Fire Test of Door Assemblies	911.4, 916.1, 916.1.1
E163-84	Fire Test of Window Assemblies	917.1
E447-84	Compressive Strength of Masonry Prisms - Test Method for	1418.2, 1419.2
E492-86	Impact Sound Transmission Through Floor/Ceiling Assemblies Using the Tapping Machine - Laboratory Measurement of	714.3

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E518-80	Flexural Bond Strength of Masonry - Test for . .	1418.2, 1419.2
E519-81	Diagonal Tension (Shear) in Masonry Assemblages - Test for	1418.2, 1419.2
E648-86	Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source - Test for	904.3, 922.7.5
E814-83	Fire Tests of Through-Penetration Fire Stops -Test Method for	915.4.1, 915.7.1

AWPA American Wood Preservers Association
P.O. Box 849
Stevensville, Maryland 21666

C1-86	Pressure Treatment (General Requirements) - All Timber Products	1712.2.2
C2-85	Pressure Treatment - Lumber, Timber, Bridge Ties and Mine Ties	1207.1, 1207.2, 1712.2.2
C3-86	Pressure Treatment - Piles	1207.1, 1219.5.1
C4-86	Pressure Treatment - Poles	1207.2
C9-85	Pressure Treatment - Plywood	1712.2.2
C20-84	Fire Retardant Pressure Treatment -Structural Lumber	903.5.2
C27-84	Fire-Retardant Pressure Treatment - Plywood	903.5.2
M4-84	Preservative Treated Wood Products - Care of .	1712.2.2
P1-78	Creosote - Standard for	1712.2.2
P2-85	Creosote - Coal Tar Solutions	1712.2.2
P5-86	Water Borne Preservatives	1712.2.2
P8-77	Oil Borne Preservatives	1712.2.2
P9-84	Organic Preservatives Systems - Standard for Solvents for	1712.2.2

AWPB

American Wood Preservers Bureau
P.O. Box 5283
Springfield, Virginia 22150

FDN-80	Softwood Lumber, Timber and Plywood Pressure Treated with Water Borne Preservatives for Ground Contact Use in - Quality Control Program for	1207.3
LP-2-80	Softwood Lumber, Timber and Plywood Pressure Treated with Water Borne Preservatives for Above Ground use - Standard for	1712.2.2, 1712.3.1
LP-22-80	Softwood Lumber, Timber and Plywood Pressure Treated with Water Borne Preservatives for Ground Contact Use - Standard for	1712.2.2, 1712.3.2, 1712.3.3
LP-33-78	Pressure Treated Lumber and Plywood with Light Petroleum Solvent Penta Solution (for Ground Contact) - Quality Control Standards for	1712.2.2, 1712.3.3
LP-44-78	Pressure Treated Lumber and Plywood with Volatile Petroleum Solvent (LPG) Penta Solution (for Ground Contact) - Quality Control Standards for	1712.2.2, 1712.3.3
LP-55-78	Pressure Treated Lumber and Plywood with Creosote or Creosote Coal Tar Solution (for Ground Contact) - Quality Control Standards for	1712.2.2, 1712.3.3
LP-77 - 78	Pressure Treated Lumber and Plywood with Heavy Petroleum Solvent Penta Solution (for Ground Contact) - Quality Control Standards for	1712.2.2, 1712.3.3
MP-1-79	Dual Treatment of Marine Piling Pressure Treated with Water Borne Preservatives and Creosote for Use in Marine Waters - Standards for	1219.5.1
MP-2 - 79	Marine Piling Pressure Treated with Creosote for Use in Marine Waters - Standard for	1219.5.1
MP-4 - 75	Marine Piling Pressure Treated with Water Borne Preservatives for Use in Marine Waters Standard for	1219.5.1

AWPI

American Wood Preservers Institute
Mail Order Section
1403 Amory Avenue
Kensington, Maryland 20895

AWPI-PBA-69	Pole Building Design	1207.2
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AWS

American Welding Society
P.O. Box 351040
Miami, Florida 33135

D1.4-79	Structural Welding Code Reinforcing Steel	1502.5.2
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BIA

Brick Institute of America
11490 Commerce Park Drive
Suite 300
Reston, Virginia 22091

BIA-69	Engineered Brick Masonry - Building Code Requirements for	908.3, 1410.1, 1412.1, 1412.2, 1417.2, 1418.1, 1804.1
TN5A-83	Sound Insulation - Clay Masonry Walls	908.3

BOCA

Building Officials and Code Administrators International
4051 West Flossmoor Road
Country Club Hills, Illinois 60477-5795

NESC-87	National Existing Structures Code	103.1
NFPC-87	National Fire Prevention Code	103.1, 200.3, 306.2.1 Table 306.2.1, 600.8, 500.8.1, 602.2, 604.1, 617.1, 619.1, 620.1, 622.2, 1000.2, 1004.8, 1005.8,

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NFPC-87	National Fire Prevention Code	1012.1, 1012.7, 1019.1.3, 3018.1
NMC-87	National Mechanical Code	200.3, 401.4.2, 401.4.3, 600.4, 600.5, 607.3, 609.3.1, 609.4, 613.3, 617.3, 619.4, 620.1, 622.3.1, 701.1, 706.3, 707.1, 709.3, 918.2, 928.1, 929.2.3, 929.2.4, 1002.20, 1002.21, 1008.6, 1010.6, 1011.1, 1303.6, 2400.2, 2500.2, 2501.1, 2501.3, 2502.1, 2503.1, 2507.3, 2508.3, 2608.5, 2701.2.3, 3005.2, 3018.3, 3204.1, 3204.2.8

CPSC

Consumer Product Safety Commission
Office of the Secretary
Washington, D.C. 20207

16CFR	Architectural Glazing Standards and	
Part 1201-86	Related Materials	2203.1, 2207.2, 2206.1
16CFR	Cellulose Insulation - Interim Safety	
Part 1209-86	Standard	928.4
16CFR	Cellulose Insulation	928.4
Part 1404-86		

CRSI

Concrete Reinforcing Steel Institute
933 N. Plum Grove Road
Schamburg, Illinois 60173-4758

CRSI-80	Reinforced Concrete Fire Resistance	903.1.1
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DOC

United States Department of Commerce
National Bureau of Standard
Washington, D.C. 20234

FF1-70	Surface Flammability of Carpet and Rugs - Standard for the (CPSC 16CFR Part 1630-85)	922.7.1
PSI-83	Plywood - Construction and Industrial	922.7.4
PS20-70	American Softwood Lumber Standard -1986 Amendments	1710.1 (Nominal Dimension)

FM

Factory Mutual Engineering Corporation
Standards Laboratories Department
1151 Boston Providence Turnpike
Norwood, Massachusetts 02062

4450-77	Class I Insulated Steel Deck Roofs - Approval Standard for	2002.3.4
4880-72	Factory Mutual Building Fire Test	2002.4

GA

Gypsum Association
1603 Orrington Avenue, Suite 1210
Evanston, Illinois 60201

216-85	Gypsum Board - Recommended Specifications for Application and Finishing of	Table 1604, 714.4,
600-84	Fire Resistance Design Manual	Table 1604

HPMA

Hardwood Plywood Manufactures Association
P.O. Box 2789
Reston, Virginia 22090

HP-SG-86	Hardwood Plywood - Structural Design Guide for	1701.1
HP-83	Hardwood and Decorative Plywood	1710.1

IMIAWC International Masonry Industry All Weather Council
 International Masonry Institute
 823 15th St., N.W.
 Washington, D.C. 20005

IMIAWC-84 Cold Weather Masonry - Recommended
 Recommended Practices and Guide
 Specifications for 1410.3

MBMA Metal Building Manufacturers Association
 1230 Keith Building
 Cleveland, Ohio 44115

MBMA-86 Low Rise Building Systems Manual 1802.1

NBS National Bureau of Standards
 Gaithersburg, Maryland 20760

211-54(A41.1) Masonry - Building Code
 Requirements for 903.3, 2112.3, 1421.1,
 1419.1

H74-60(A41.2) Reinforced Masonry
 - Building Code Requirements for 903.3, 1410.1, 1411.1,
 1412.1, 1418.1, 1804.1

NCMA National Concrete Masonry Association
 2302 Horse Pen Road
 Herndon, Virginia 22070

TEK69 A-78 STC Values of Concrete Masonry Walls . . 714.4
 TR 75-B-85 Design and Construction of Load Bearing
 Concrete Masonry - Specifications for . . 908.3, 113.5.3.1,
 1410.1, 1411.1, 1412.1,
 1418.1, 1422.3, 1804.1

THE MASSACHUSETTS STATE BUILDING CODE

NFPA

National Fire Protection Association

Batterymarch Park

Quincy, Massachusetts 02269

10-84	Installation, Maintenance and Use of Portable Fire Extinguishers	1021.2
11-83	Foam Extinguishing Systems	1007.1
11A-83	High Expansion Foam Systems	1007.1
12-85	Carbon Dioxide Extinguishing Systems	1008.1, 1008.5
12A-85	Halogenated Extinguishing Agent Systems - Halon 1301	1009.1, 1009.5
12B-85	Halogenated Fire Extinguishing Agent Systems - Halon 1211	1009.1, 1009.5
13-89	Installation of Sprinkler Systems	606.3, 907.1.1, 1004.1, 1004.3, 637.16
13D-89	Installation of Sprinkler Systems in One- and Two- Family Dwellings and Mobile Homes - Standard for the	636.3.5
13R-89	<u>Sprinkler Systems in Residential Occupancies up to Four Stories in Height</u>	
14-86	Standpipe and Hose Systems	1012.1
15-85	Water Spray Fixed Systems	1006.1, 1006.4
16-86	Foam Water Sprinkler and Spray Systems	1007.1
17-85	Dry Chemical Extinguishing System	1010.1, 1010.5
17A-86	Liquid Agent Extinguishing Systems - Standard for the Installation of	1011.1, 1011.2
26-83	Supervision of Water Supply Values	1004.6
30-84	Flammable and Combustible Liquids Code	603.4, 619.1
32-85	Dry Cleaning Plants	619.4
33-85	Spray Application Using Flammable and Combustible Materials	622.1
34-87	Dipping and Coating Process Using Flammable or Combustible Liquids - Standard for	622.1
40-82	Cellulose Nitrate Motion Picture Film	613.1
50-85	Bulk Oxygen Systems at Consumer Sites	2510.1
51-83	Oxygen-Fuel Gas Systems for Welding, Cutting and Allied Processes	2510.1
56F-83	Nonflammable Medical Gas Systems	2509.1
61A-84	Manufacturing and Handling Starch	617.1
61B-80	Prevention of Fire and Dust Explosions in Grain Elevators and Bulk Grain Handling Facilities	617.1

REFERENCED STANDARDS

61C-84	Prevention of Fire and Dust Explosion in Feed Mills	617.1
61D-84	Milling of Agricultural Commodities for Human Consumption	617.1
65-80	Processing and Finishing of Aluminum	617.1

THE MASSACHUSETTS STATE BUILDING CODE

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NFiPA

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71-85	Central Station Signaling Systems	636.3.8, 637.12.1, 1 1020.1, 1018.3.4.6, 1017.7.2.4
72A-85	Local Protective Signaling Systems	635.4.1, 636.3.6, 636.3.8, 1017.5, 1017.6, 1017.7.2.4, 1018.3.4.3, 1018.3.4.4, 1018.3.4.8, 1020.1
72B-86	Installation, Maintenance and Use of Auxiliary Protective Signaling System	637.12.1, 1018.3.4.6, 1020.1
72C-86	Remote Station Protective Signaling Systems . . .	636.3.8, 637.12.1, 1020.1, 1018.3.4.6
72D-86	Proprietary Protective Signaling Systems	1020.1
72E-84	Automatic Fire Detectors	636.3.7, 1018.1, 1018.3.4, 1018.3.4.1, 1018.3.4.2 1019.4.1, 2611.4
72F-85	Standard for the Installation, Maintenance and Use of Emergency Voice/Alarm Communication System	1017.7.2.4,
74-75	Installation, Maintenance and Use of Household Fire Warning Equipment	1018.3.4.1, 1018.3.4.3
80-86	Fire Doors and Windows	909.3.1, 916.2
82-83	Incinerators, Waste and Linen Handling Systems and Equipment Standard on	2506.1
85F-82	Pulverized Fuel Systems - Installation and Operation	617.1
99-84	Health Care Facilities	2509.2
101-85	Code for Safety to Life from Fire in Buildings and Structures	632.1
102-86	Assembly Seating, Tents and Air Supported Structures	612.1
231C-86	Rack Storage of Materials, Standard for	504.1, Table 930
418-79	Roof-top Heliport Construction and Protection .	614.3
495-85	Code for Explosive Materials	Table 306.2.1
651-80	Manufacture of Aluminum or Magnesium Powder - Standard for the	617.1
653-71	Dust Explosions in Coal Plants, - Prevention of	617.1
654-82	Dust Explosions in the Plastics Industry - Prevention of	617.1
655-82	Sulfur Fires and Explosions - Prevention of . . .	617.1

NFiPA (Continued)

664-81	Dust Explosions in Woodworking and Wood Floor Manufacturing Plants - Prevention of	617.1
701-77	Fire Tests for Flame Resistant Textile and Film - Standard Methods of	604.2.2, 626.5, 904.4.1, 904.4.3, 2907.4.2
704-85	Identification of the Fire Hazard of Materials . .	201.0 (Hazardous production material - HPM) 603.5.1

NFoPA National Forest Products Association

1250 Connecticut Avenue, N.W.
Washington, D.C. 20036

NFoPA-81	Design Values for Joists and Rafters	1705.2, 1706.1
NFoPA-77	Span Tables for Joists and Rafters	1705.2, 1706.1
NFoPA	National Design Specification for Wood Construction - 86 Supplement - Design Values for Wood Construction	1207.1, 1702.1, 1705.2, 1706.1
TR7-82	All Weather Wood Foundation System - Basic Requirements, 1983 Supplement	1207.3, 1224.3

PCI Prestressed Concrete Institute

175 West Jackson Blvd.
Chicago, Illinois 60604

MNL-122 -82	Fire Resistance of Precast Prestressed Concrete - Design for	903.11
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RCSHSB Red Cedar Shingle and Handsplit Shake Bureau
515 116th Avenue, N.E., Suite 275
Bellevue, Washington 98004

RCSHSB-84	Centigrade Red Cedar Shingles - Grading rules for	2302.1
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SFES Southeastern Forest Experiment Station
U.S. Dept. of Agriculture
Forest Service
200 Weaver Blvd., P.O. Box 2680

General Technical Report No. SE-33-85	Performance and Quality Control Standards for Composite Floor, Wall and Truss Framing	1708.4
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SJI Steel Joist Institute
1205 48th Avenue North
Suite A
Myrtle Beach, South Carolina 29577

SJI-86	Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders	1803.1
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TFS Texas Forest Service
P.O. Box 310
Lufkin, Texas 75901

TFS-85	Preservative Treated Southern Yellow Pine Taper Sawn Shakes - Grading Rules for	2302.1
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TPI

Truss Plate Institute Inc.
583 D'Onofrio Drive
Suite 200
Madison, Wisconsin 53719

TPI-85	Trusses - Design Specifications for Metal Plate Connected Wood - 1985 Supplement	1706.1
PCT-80	Design Specification for Metal Plate Connected Parallel Chord Trusses - 1980 Supplement	1705.2

UL

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, Illinois 60062

10A-85	Doors - Tin Clad Fire Doors	916.2
14B-84	Sliding Hardware for Standard Horizontally Mounted Tin-Clad Fire Doors	916.2
14C-84	Swinging Hardware for Standard Tin-Clad Fire Doors	916.2, 1018.3.4.7
217-86	Single and Multiple Station Smoke Detectors . . .	610.6.1, 635.4.1
268-86	Smoke Detectors for Fire Protective Signaling Systems	610.6.1
555-86	Fire Dampers, and Ceiling Dampers	918.1
910-85	Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables used in Air-Handling Spaces - Test Method for	929.2.5
1256-85	Fire Test of Roof Deck Construction	2002.3.4
Subject	Outline of Investigation for Insulated Wall Construction	2002.4
1040-85	Test Method for the Classification of Interior Finish Material Assemblies Using A Room Fire Test	2002.4
Subject	Fire Resistance Directory	903.1.2
1715-83		
UL-86		

USD United States Diving, Inc.
901 W. New York Street
Indianapolis, Indiana 46202

USD-85	1985-86 Rules and Regulations of United States Diving, Inc.	625.9.1
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REFERENCED STANDARDS

Part II

The following is a listing of recognized standards not specifically referenced in this code.

NFiPA National Fire Protection Association
Batterymarch Park
Quincy, Massachusetts 02269

13A-87	Care and Maintenance of Sprinkler Systems - Recommended Practice for
13R-89	Sprinkler Systems in Residential Occupancies up to Four Stories in Height - Standard for the Installation of
20-89	Centrifugal Fire Pumps - Standard for the Installation of
22-87	Water Tanks for Private Fire Protection - Standard for
<u>72H-88</u>	<u>Testing Procedures for Local, Auxiliary Remote Station and Proprietary Protective Signaling Systems</u> - <u>Guide for</u>
130-88	Fixed Guideway Transit Systems - Standard for

CS&SB

Cedar, Shake and Shingle Bureau
515-116TH Avenue N.E, Suite 275
Bellevue, WA 98004

Exterior and Interior Walls - Design and Application

Manual for, 1989

New Roof Coverings - Red Cedar Shingle and Shake Design and Application

Manual for, 1989

Red Cedar Shingles -

Grading Rules for Certi-Grade, 1984

Wood Shakes -

Grading Rules for Certi-Sawn Taper Sawn Red Cedar Shakes, 1981

Grading Rules for Certi-Split Red Cedar Shakes, 1985

Wood Shingles -

Grading Rules for Certi-Grade Shingles, 1984

APPENDIX B

UNIT DEAD LOADS FOR DESIGN PURPOSES

The intent of this appendix is to assist the designer and building official in establishing the minimum weights for materials commonly used in building construction. Some material assemblies have a range in weight. A typical figure is indicated, but when there is reason to suspect a considerable deviation, the actual weight should be determined.

Note on use of Appendix B tables: When making calculations based on the tables in this appendix, the weights of masonry include mortar but not plaster. For plaster, add 5 psf for each face plastered. Values given represent averages. In some cases there is a considerable range of weight for the same construction. For metric conversion, 1 psf equals 4.882 kg/m³.

Table B-1
UNIT DESIGN DEAD LOADS FOR CONCRETE SLABS

Concrete slabs	Pounds per square foot
Concrete, reinforced stone, per inch of thickness	12 1/2
Concrete, reinforced lightweight sand, per inch of thickness	9 1/2
Concrete, reinforced, lightweight, per inch of thickness	9
Concrete, plain stone, per inch of thickness	12
Concrete, plain, lightweight, per inch of thickness	8 1/2

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**Table B-2
UNIT DESIGN DEAD LOADS FOR RIBBED SLABS**

	Pounds per square foot					
Ribbed slabs Depth in inches (rib depth plus slab thickness)*	Width of rib, in inches					
	4	5	6	7	8	9
12-inch clay tile fillers (normal weight concrete)						
4 plus 2	49	51	52	54	-	-
6 plus 2	60	63	65	67	-	-
8 plus 2 1/2	79	82	85	87	-	-
10 plus 3	96	100	103	106	-	-
12 plus 3	108	112	116	120	-	-
20-inch wide forms:	45	48	50	50	-	-
6 plus 2 1/2	51	54	57	60	-	-
8 plus 2 1/2	57	60	64	68	-	-
10 plus 2 1/2	63	67	72	76	-	-
12 plus 2 1/2	-	74	79	84	-	-
14 plus 2 1/2	-	-	88	93	98	-
16 plus 2 1/2	-	-	-	111	118	-
20 plus 2 1/2		-				

* Make appropriate allowances for tapered ends.

UNIT DEAD LOADS FOR DESIGN PURPOSES

Table B-2 (continued)
UNIT DESIGN DEAD LOADS FOR RIBBED SLABS

Ribbed slabs Depth,, in inches (rib depth plus slab thickness)*	Pounds Per square foot					
	Width of rib, in inches					
	4	5	6	7	8	9
30-inch wide forms:						
6 plus 2 1/2	41	43	45	47	-	-
8 plus 2 1/2	45	47	50	53	-	-
10 plus 2 1/2	49	52	55	58	-	-
12 plus 2 1/2	53	57	60	64	-	-
14 plus 2 1/2	-	62	66	70	-	-
16 plus 2 1/2	-	-	72	76	80	-
20 plus 2 1/2	-	-	-	90	95	101
Two-way clay tile fillers (12x12):						
4 plus 2	61	62	64	-	-	-
6 plus 2	87	89	90	-	-	-
8 plus 2 1/2	100	103	107	-	-	-
10 plus 3	121	126	131	-	-	-
12 plus 3	136	141	146	-	-	-

Table B-3
UNIT DESIGN DEAD LOADS FOR WAFFLE SLABS

Waffle slabs Depth, in inches (Rib depth plus slab thickness)	Pounds per square foot
19x19, 5 @ 24	
6 plus 2 1/2	66
8 plus 2 1/2	78
10 plus 2 1/2	84
12 plus 2 1/2	101
30x30, 6 @ 36	
8 plus 3	73
10 plus 3	83
12 plus 3	95
14 plus 3	106
16 plus 3	114
20 plus 3	135

UNIT DEAD LOADS FOR DESIGN PURPOSES

Table B-4
UNIT DESIGN DEAD LOADS FOR FLOOR FINISH

Floor finish	Pounds per square foot
Double 7/8-inch wood on sleepers, light concrete fill	19
Double 7/8-inch wood on sleepers, stone concrete fill	28
Single 7/8-inch wood on sleepers, light concrete fill	16
Single 7/8-inch wood on sleepers, light concrete fill	25
3-inch wood block on mastic, no fill	10
1-inch cement finish on stone concrete fill	32
1-inch terrazzo on stone concrete fill	32
Marble and mortar on stone concrete fill	33
Linoleum on stone concrete fill	32
Linoleum on light concrete fill	22
1 1/2-inch asphalt mastic flooring	18
3-inch wood block on 1/2-inch mortar base	16
Solid flat tile on 1-inch mortar base	23
2-inch asphalt block, 1/2- mortar	30
1-inch terrazzo, 2-inch stone concrete	32
Floor finish tile per inch depth	12
Cement finish per inch depth	12
Gypsum slabs per inch depth	4
Precast concrete plank per inch	(as determined by test)
Hardwood flooring per inch depth	4
Underflooring per inch depth	3
Linoleum	2
Asphalt tile	2
Brick pavers per inch thickness	10

Table B-5
UNIT DESIGN DEAD LOADS FOR WATERPROOFING

Waterproofing	Pounds per square foot
Five-ply membrane	5

Table B-6
UNIT DESIGN DEAD LOADS FOR FLOOR FILL

Floor Fill	Pounds per square foot
Cinder fill, per inch	5
Cinder concrete per inch	9
Lightweight concrete, per inch	7
Sand, per inch	8
Stone, concrete, per inch	12

Table B-7
UNIT DESIGN DEAD LOADS FOR WOOD JOIST FLOORS

Wood joist floors (no plaster) - double wood floor joist sizes in inches	Pounds per square foot	
	12-inch spacing	16-inch spacing
2 x 6	6	5
2 x 8	6	6
2 x 10	7	6
2 x 12	8	7
3 x 6	7	6
3 x 8	8	7
3 x 10	9	8
3 x 12	11	9
3 x 14	12	10

Table B-8
UNIT DESIGN DEAD LOADS FOR MATERIALS

Materials	Pounds per cubic foot
Cast stone masonry (cement, stone, sand)	144
Cinder fill	57
Concrete, plain:	
Cinder	108
Expanded slag aggregate	100
Haydite (burned clay aggregate)	90
Slag	132
Stone (including gravel)	144
Vermiculite and perlite aggregate, nonloadbearing	25-50
Other light aggregate, loadbearing	70-105
Concrete, reinforced:	
Cinder	111
Slag	138
Stone (including gravel)	150
Earth (dry)	96
Earth (damp)	108
Earth (wet)	120
Cork	15
Masonry, ashler:	
Granite	168
Limestone, crystalline	168
Limestone, oolitic	135
Marble	173
Sandstone	144
Masonry, rubble mortar:	
Granite	153
Limestone, crystalline	147
Limestone, oolitic	138
Marble	156
Sandstone	137
Rubble stone masonry	156
Terra cotta, architectural:	
Voids filled	120
Voids unfilled	72
Timber, seasoned:	
Ash, commercial white	41
Cypress, southern	32
Fir, Douglas, Coast region	34

Table B-8
UNIT DESIGN DEAD LOADS FOR MATERIALS

Materials

Pounds per cubic foot

Oak, commercial reds and whites	45
Redwood	28
Spruce, red, white, and Sitka	28
Southern pine, short leaf	39
Southern pine, long leaf	48
Timber, hemlock	30

Table B-9
UNIT DESIGN DEAD LOADS FOR ROOF AND WALL COVERINGS

Roof and wall coverings	Pounds per square foot
Asphalt shingles	2
Cement asbestos shingles	4
Cement tile	16
Clay tile (for mortar add 10 lb):	
2-inch book tile	12
3-inch book tile	20
Roman	12
Ludowici	19
Composition:	10
Three-ply ready roofing	
Four-ply felt and gravel	1
Five-ply felt and gravel	5 1/2
Copper or tin	6
Corrugated asbestos cement roofing	1
Fiber board, 1/2 inch	1-3
Formed sheet steel	(see manufacturer)
Formed steel decking	2
Gypsum sheathing, 1/2 inch	3/4
Rigid insulation, 1/2 inch	3
Sheet lead	8
Skylight, metal frame, 3/8-inch wired glass	7
Slate 3/16-inch	10
Slate 1/4 inch	20
Spanish tile	3
Wood sheathing, per inch thickness	3
Wood shingles	

UNIT DEAD LOADS FOR DESIGN PURPOSES

Table B-10
UNIT DESIGN DEAD LOADS FOR SUSPENDED CEILINGS

Suspended ceilings	Pounds per square foot
Cement on wood lath	12
Cement on metal lath	15
Gypsum on wood or metal lath	10
Plaster on tile or concrete	5
Suspended metal lath and gypsum plaster	10
Suspended metal lath and cement plaster	15
Plaster on wood lath	8

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Table B-11
UNIT DESIGN DEAD LOADS FOR UNPLASTERED WALLS AND
PARTITIONS

Walls and partitions (unplastered)	Pounds per square foot
4 -inch clay brick, high absorption	34
4 -inch clay brick, medium absorption	39
4 -inch clay brick, low absorption	46
4 -inch sand/lime brick	38
4 -inch concrete brick, heavy aggregate	46
4 -inch concrete, light aggregate	33
8 -inch clay brick, high absorption	69
8 -inch clay brick, medium absorption	79
8 -inch clay brick, low absorption	89
8 -inch sand/lime brick	74
8 -inch concrete brick, heavy aggregate	89
8 -inch concrete brick, light aggregate	68
12 -inch common brick	120
12 -inch pressed brick	130
12 -inch sand/lime brick	105
12 1/2 - inch concrete brick, heavy aggregate	130
12 1/2 - inch concrete brick, light aggregate	98
17 -inch clay brick, high absorption	134
17 -inch clay brick, medium absorption	155
17 -inch clay brick, low absorption	173
17 -inch sand/lime brick	138
17 -inch concrete brick, heavy aggregate	174
17 -inch concrete brick, light aggregate	130
22 -inch clay brick, high absorption	168
22 -inch clay brick, medium absorption	194
22 -inch clay brick, low absorption	216
22 -inch sand/lime brick	173
22 -inch concrete brick, heavy aggregate	216
22 -inch concrete brick, light aggregate	160
4 -inch brick, 4 inch load bearing structural clay - tile backing	60
4 -inch brick, 8 inch loadbearing structural clay - tile backing	75
8 -inch brick, 4 inch loadbearing structural clay - tile backing	102
8 -inch combination brick and concrete block	72
12 -inch combination brick and concrete block	90
8 -inch loadbearing structural clay tile	42
12 -inch loadbearing structural clay tile	58

Table B-11 (continued)
**UNIT DESIGN DEAD LOADS FOR UNPLASTERED WALLS AND
PARTITIONS**

Walls and partitions (unplastered)	Pounds per square foot
<hr/>	
8 -inch concrete block, heavy aggregate	55
12 -inch concrete block, heavy aggregate	85
8 -inch concrete block, light aggregate	38
12 -inch concrete block, light aggregate	55
2 -inch furring tile, one side of masonry wall, - add to above figures	12
4 -inch hollow concrete block - stone aggregate	30
-lightweight	20
6 -inch hollow concrete block - stone aggregate	42
-lightweight	30
8 -inch hollow concrete block	55
-lightweight	38
10 -inch hollow concrete block - stone aggregate	62
-lightweight	46
12 -inch hollow concrete block - stone aggregate	85
-lightweight	55
4 -inch solid concrete block - stone aggregate	45
-lightweight	34
6 -solid concrete block - stone aggregate	50
-lightweight	37
8 -inch solid concrete block - stone aggregate	67
-lightweight	48
10 -inch solid concrete block - stone aggregate	84
-lightweight	52
12 -inch concrete block - stone aggregate	108
-lightweight	72
4 -inch loadbearing clay tile	24
6 -inch loadbearing clay tile	36
2 -inch nonloadbearing clay tile	11
3 -inch nonloadbearing clay tile	18
4 -inch nonloadbearing clay tile	20
6 -inch nonloadbearing clay tile	30
8 -inch nonloadbearing clay tile	36
10 -inch nonloadbearing clay tile	40
4 -inch nonloadbearing hollow concrete block	20
6 -inch nonloadbearing hollow concrete block	30
8 -inch nonloadbearing hollow concrete block	40
T.C. 1 1/2-inch split terra cotta furring	8

Table B-11 (continued)
UNIT DESIGN DEAD LOADS FOR UNPLASTERED WALLS AND
PARTITIONS

Walls and partitions (unplastered) Pounds per square foot

2 -inch split terra cotta furring	10
3 -inch split terra cotta furring	12
2 -inch hollow gypsum block	9.5
3 -inch hollow gypsum block	10
4 -inch hollow gypsum block	15
5 -inch hollow gypsum block	18
6 -inch hollow gypsum block	24
2 -inch solid gypsum block	12
3 -inch solid gypsum block	18
4 -inch solid gypsum block	24
2 -inch facing tile	15
4 -inch facing tile	25
6 -inch facing tile	38
2 -inch solid plaster	20
4 -inch solid plaster	32
4 -inch hollow plaster	22
Wood studs 2x4, unplastered	4
Wood studs 2x4, plastered one side	12
Wood studs 2x4, plastered two sides	20
4 -inch glass block	18

UNIT DEAD LOADS FOR DESIGN PURPOSES

Table B-12

UNIT DESIGN DEAD LOADS FOR LATH AND PLASTER PARTITIONS

Lath and plaster partitions	Pounds per square foot
2 -inch solid cement on metal lath	25
2 -inch solid gypsum on metal lath	18
2 -inch solid gypsum on gypsum lath	18
2 -inch metal studs, gypsum and metal lath both sides	18
3 -inch metal studs, gypsum and metal lath both sides	19
4 -inch metal studs, gypsum and metal lath both sides	20
6 -inch wood studs, plaster and wood lath both sides	18
6 -inch wood studs, plaster and metal lath both sides	18
6 -inch wood studs, plaster and plaster boards both sides	18
6 -inch wood studs, unplastered gypsum board both sides (dry wall)	10

Table B-13

UNIT DESIGN DEAD LOADS FOR PLASTER WORK

Plaster Work	Pounds per square foot
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Gypsum (one side)	5
Cement (one side)	10
Gypsum on wood lath	8
Gypsum on metal lath	8
Gypsum on plaster board or fiber board	8
Cement on wood lath	10
Cement on metal lath	10

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APPENDIX C

RECOMMENDED FASTENING SCHEDULE

Building element	Nail size and type	Number and location
Stud to sole plate	8d common	4 toe-nail or
	16d common	2 direct-nail
Stud to cap plate	16d common	2 toe-nail or
		2 direct-nail
Double studs	10d common	12" o.c. direct
Corner studs	16d common	24" o.c. direct
Sole plate to joist or blocking	16d common	16" o.c.
Double cap plate	10d common	16" o.c. direct
Cap plate laps	10d common	2 direct-nail
Ribbon strip, 6" or less	10d common	2 each direct bearing
Ribbon strip, 6" or more	10d common	3 each direct bearing
Roof rafter to plate	8d common	3 toe-nail
Roof rafter to ridge	16d common	2 toe-nail or direct nail
Jack rafter to hip	10d common	3 toe-nail or
	16d common	2 direct-nail
Floor joists to studs	10d common	5 direct or
(No ceiling joists)	10d common	3 direct
Floor joists to studs	10d common	2 direct
(With ceiling joists)		
Floor joists to sill or girder	3d common	3 toe-nail
Ledger strip	16d common	3 each direct
Ceiling joists to plate	16d common	3 toe-nail
Ceiling joists (laps over partition) . .	10d common	3 direct-nail
Ceiling joists (parallel to rafter) . .	10d common	3 direct
Collar beam	10d common	3 direct
Bridging to joists	8d common	2 each direct end
Diagonal brace (to stud & plate) . . .	8d common	2 each direct bearing
Tail beams to headers	20d common . . .	1 each end 4 sq. ft.
(When nailing permitted)		floor area
<u>Header</u> beams to trimmers	20d common . . .	1 each end 8 sq. ft.
		floor area

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Building element	Nail size and type	Number and location
1" roof decking (6" or less in width)	8d common	2 ea. direct rafter
1" roof decking (over 6" in width)	8d common	3 each direct rafter
1 " subflooring (6" or less)	8d common	2 each direct joist
1" subflooring (8" or more)	8d common	3 each direct joist
2" subflooring	16d common	2 each direct joist
1" wall sheathing (8" or less in width)	8d common	2 each direct stud
1" wall sheathing (over 8" in width)	8d common	3 each direct stud
Plywood roof & wall sheathing (1/2" or less)	6d common	6" o.c. direct edges & 12" o.c. intermediate
(5/8" or greater)	8d common	6" o.c. direct edges & 12" o.c. intermediate
(5/16", 3/8", or 1/2")	16 gauge galvanized wire staples, 3/8" minimum crown; length of 1" plus plywood thickness	4" o.c. edges & 8" o.c. intermediate
(5/8")	Same as immediately above	2 1/2" o.c. edges & 5" o.c. intermediate
Plywood subflooring:		
(1/2")	6d common or 6d annular or spiral thread	6" o.c. direct edges & 10" o.c. intermediate
(5/8", 3/4")	8d common or 8d annular or spiral thread	6" o.c. direct edges & 10" o.c. intermediate
(1", 1 1/8")	10d common or 8d ring shank or 8d annular or spiral thread	6" o.c. direct edges & 6" o.c. intermediate
(1/2")	16d galvanized wire staples	4" o.c. edges & 7" o.c. intermediate
(5/8")	3/8" minimum crown, 1 5/8" length	2 1/2" o.c. edge 4" o.c. intermediate

RECOMMENDED FASTENING SCHEDULE

Building element	Nail size and type	Number and location
Built-up girders and beams	20d common . . .	32" o.c. direct
Continuous header to stud	8d common	4 toe nail
Continuous header, two pieces	16d common . . .	16" o.c. direct
1/2" fiber board sheathing	1 1/2" galvanized roofing nail or 16 gauge staple, 1 1/2" long with min. crown of 7/16"	3" o.c. exterior edge 6" o.c. intermediate
25/32" fiber board sheathing	1 3/4" galvanized roofing nail or 8d common nail or 16 gauge staple, 1 1/2" long with min. crown of 7/16"	3" o.c. exterior edge 6" o.c. intermediate
Gypsum sheathing	12 gauge 1 3/4" . large head corrosion-resistant	4" o.c. on edge 8" o.c. intermediate
Particle board underlayment (1/4"-3/4")	6d annular threaded	6" o.c. direct edges 10" o.c. intermediate
Particle board roof and wall sheathing 1/2" or less	6d common	6" o.c. direct edges 12" o.c. intermediate
5/8" or greater	8d common	6" o.c. direct edges 12" o.c. intermediate
Particle board subflooring (5/8" or greater)	8d common	6" o.c. direct edges 12" o.c. intermediate
Shingles, wood ^a	No. 14 B&S Gage corrosion resistive	2 each bearing
Weather boarding	8d corrosion . . .	2 each bearing

Note a: Shingle nails shall penetrate not less than 3/4" into nailing strips, sheathing or supporting construction except as otherwise provided in Section 1225.4.4.

Table C-1
Maximum Spacing of Gypsum Wallboard Fasteners
(For nonfireresistance rated construction assemblies)

Thickness of gypsum wallboard (inch)	Plane of framing surface	Long dimension of gypsum wall-board sheets in relation to direction of framing members	Maximum spacing of framing members (center-to-center in inches)	Maximum spacing of fasteners (center-to-center in inches)		Nails to wood
				Nails	Screws	
1/2	Horizontal	Either direction	16	7	12	No. 13 gage, 1 3/8" long, 19/54" head No. 098 gage, 1 1/4" long, Annular ringed 5d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either direction	24	8	12	
5/8	Horizontal	Either direction	16	7	12	No. 13 gage, 1 5/8" long, 19/64" head No. 098 gage, 1 3/8" long, Annular ringed 6d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either direction	24	8	12	

Fastening required with adhesive application

Thickness of gypsum wallboard (inch)	Plane of framing surface	Long dimension of gypsum wall-board sheets in relation to direction of framing members	Maximum spacing of framings members (center-to-center in inches)	Maximum spacing of fasteners (center-to-center in inches)		Nails to wood
				Nails	Screws	
1/2 or 5/8	Horizontal	Either direction	16	16	16	As required for 1/2" and 5/8" gypsum wallboard, see above
	Vertical	Perpendicular Either direction	24 24	12	16	
2 layers each 3/8" (3/4" total)	Horizontal	Perpendicular	24	16	16	Base ply nailed as required for 1/2" gypsum wallboard and face ply placed with adhesive
	Vertical	Either direction	24	24	24	

Notes to Table C-1:

Note a. Where the metal framing has a clinching design formed to receive the nails by two edges of metal, the nails shall be not less than 5/8 inch longer than the wallboard thickness, and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d cooler nail (No. 13 1/2 gage, 1 5/8 inches long, 15/ 64 inch head) for 1/2 inch gypsum wallboard; 6d cooler (No. 13 gage, 1 7/8 inches long, 15/64 head) for 5/8-inch gypsum wallboard.

(Table notes continued on next page)

RECOMMENDED FASTENING SCHEDULE

Notes to Table C-1 (continued)

Note b. Two nails at 2 inches to 2 1/2 inches apart may be used if the pairs are spaced 12 inches center-to-center except around perimeters.

Note c. Screws shall be No. 6 with tapered head and long enough to penetrate into wood framing not less than 5/8 inch and metal framing not less than 1/4 inch

Note d. All nails shall meet ASTM C514 or Federal Specification FF-N-105C.

Note e. For fireresistance rated construction, see the pertinent fire test information.

Note f. 1 inch = 25.4 mm.

Table C-2
Allowable Shear for Wind or Seismic Forces in Pounds Per Foot
For Vertical Diaphragms of Lath and Plaster or Gypsum Board Frame Wall
Assemblies

Type of material	Thickness of Material	Wall Construction	Nail spacing maximum (in inches)	Shear value	Minimum nail size
Gypsum lath, plain or perforated	3/8" Lath and 1/2" Plaster	Unblocked	5	100	No. 13 gage, 1 1/8" long, 19/64" head, plasterboard blued nail.
Gypsum sheathing board	1/2" x 2'x 8' 1/2"x4' 1/2"x4'	Unblocked Blocked Unblocked	4 7	75	No. 11 gage, 1 1/4" long, 7/64" head, diamond point, galvanized.
Gypsum Wallboard or Veneer base	1/2"	Unblocked	7	175	5d Cooler nails
			4	100	
		Blocked	7	100	
			4	125	
	5/8"	Blocked Two ply	4	125	6d cooler nails
			Base ply 9	150	
			Face ply 7	175	
				250	

Note a. These vertical diaphragms shall not be used to resist loads imposed by masonry or concrete construction. Values are for short time loading due to wind or earthquake and must be reduced 25 percent for normal loading

Note b. Applies to nailing at all studs, top and bottom plates and blocking.

Note c. Values shown are for gypsum board applied to one side only. The shear values may be doubled when identical materials are applied to both sides of wall

Note d. 1 inch=25.4 mm.

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APPENDIX D

GUIDANCE FOR SELECTION OF FOUNDATION MATERIAL CLASSES IN TABLE 1201

D-101.0 Purpose: The purpose of this appendix is to provide guidance for the selection of the material class and consistency in place when using Table 1201.

D-102.0 Application: This appendix is provided only as a general guide to engineering judgment. All available data should be evaluated and professional engineering judgment exercised in selection of the appropriate material classification for use with Table 1201. The references on soil and rock classification and typical ranges of index properties provided in this appendix should not be considered to be code requirements.

D-103.0 Classification of Soil: Guidelines for generally accepted engineering practice in the description and classification of soils are provided in ASTM D2488-84 Description and identification of Soils (Visual-Manual Procedure) and ASTM D2487-85 Classification of Soils for Engineering Purposes.

D-104.0 Classification of Rock: Guidelines for generally accepted engineering practice in the description and classification of rocks are provided in Chapter 1 of Design Manual 7.1 - Soil Mechanics, Naval Facilities Engineering Command, May 1982 (NAVFAC DM-7.1)

D-105.0 Typical Index Properties: Typical ranges of index properties for the Material Classes listed in Table 1201 are provided in Table D-1.

FOUNDATION MATERIAL CLASSES

TABLE D-1 TYPICAL RANGE OF INDEX PROPERTIES

Material Class	Description	Consistency in Place	Rock Quality Designation RQD%	Unconfined Compressive	St. Penetration Resistance N. blow/Ft
1	Massive bedrock - granite, diorite, gabbro, basalt, gneiss, quartzite, well-cemented conglomerate	Hard rock minor jointing Hard sound rock moderate jointing	> 75 50 to 75	> 8000	-
2	Foliated bedrock	Medium hard rock minor jointing	> 50	> 8000	-
3	Sedimentary bedrock - cementation shale, silt-stone, sandstone, limestone, dolomite, conglomerate	Soft rock, jointing	> 50		-
4	Weakly cemented sedimentary bedrock - compaction shale or other similar rock in sound condition	Very soft rock	< 50		
5	Weathered bedrock - any of the above except shale	Very soft rock weathered and/or major jointing and fracturing	< 50		-
6	Slightly cemented sand and/or gravel, glacial till (basal or lodgement), haropan	Very dense	-		> 50

TABLE D-1 (continued)

Material Class	Description	Consistency in Place	Rock Quality Designation RQD%	Unconfined Compressive	St. Penetration Resistance N. blow/Ft
7	Gravel, widely graded sand and gravel, and granular ablation till	Very dense Dense Medium dense Loose Very loose	-		>50 41-50 16-40 8-15 <8
8	Sands and non-plastic silty sands with little or no gravel (except for Class 9 materials)	Dense Medium dense Loose Very loose	-		>30 11-30 6-10 <6
9	Fine sand, silty sand and non-plastic inorganic silt	Dense Medium dense loose Very loose	-		>30 11-30 6-10 <6
10	Inorganic sandy or silty clay, clayey sand, clayey silt, clay or varied clay low to high plasticity	Hard Stiff Medium Soft	-		>20 9-20 4-8 <4
11	Organic soils - peat organic silts, organic clay	-	-		-

See Table D-1 Notes on following page

Notes to table D-1

- Note 1:** For discussion of RQD values see Deere, D.U., Rock Mechanics in Engineering Practice (Chapter 1), Stagg and Zinkiewicz, Eds., 1968, John Wiley and Sons, Inc.
- Note 2:** For determination of Unconfined Compressive Strength see ASTM D2938.
- Note 3:** For determination of Standard Penetration Resistance N-value see ASTM D1586. The presence of large particles (coarse gravel, cobbles, boulders) may cause N-values to be unrealistically high. Such values should not be used. Also standard penetration resistance should not be used over depths less than five (5) feet.

APPENDIX E

PROCEDURE FOR ACCOUNTING FOR SERIES AND PARALLEL HEAT FLOW PATHS

E1: For envelope assemblies containing metal framing: The U_i shall be determined by using one of the following methods:

1. Results from laboratory or field test measurements. One of the procedures specified in Section 3108.2 of this Article shall be used.
2. The thermal resistance of those roof and wall assemblies listed in Tables E-1 and E-2 shall be corrected using the following procedures:

The total resistance of the heat flow path (R_t) is determined from the Equation E-1:

$$R_t = R_i + R_e \quad \text{Equation E-1}$$

Where:

$$R = 1/U$$

R_t = the total resistance of the envelope assembly.

R_i for: $i = 1$ to n , is the resistance of the series elements.

R_e is the equivalent resistance of the element containing the parallel path, and the value of R_e is:

$$R_e = R \text{ value of insulation} \times F_c \quad \text{Equation E-2}$$

(where F_c is the parallel path correction factor)

The Parallel Path correction Factors (F_c) may be obtained from tests conducted using procedures listing in Section 3108.2 of this Article. Parallel Path Correction Factors for some envelope assemblies are listed in Tables E-1 and E-2.

TABLE E-1
ROOFS: PARALLEL PATH CORRECTION FACTORS⁽¹⁾

Bridged R-Value	0	5	10	15	20	25	30	40	45	50	55
Correc- tion Factor	1.0	0.96	0.92	0.88	0.85	0.79	0.76	0.73	0.71	0.69	0.67

(1) Table E-1 values are based upon: Metal trusses with 4-ft. spacing that penetrate the insulation, and 0.66 inch diameter crossmembers every 1 ft.

TABLE E-2
**WALL SECTIONS WITH METAL STUDS: PARALLEL PATH
CORRECTION FACTORS**

Size of Members	Gauge of Stud	Spacing of Framing	Cavity Insulation R-Value	Correction Factor
2 x 4	18 - 16	16" o.c.	R-11	0.50
2 x 4	18 - 16	24" o.c.	R-11	0.60
2 x 6	18 - 16	16" o.c.	R-19	0.40
2 x 6	18 - 16	24" o.c.	R-19	0.45

TABLE E-3
CALCULATION PROCEDURES FOR EVALUATING ALL SERIES
AND PARALLEL HEAT FLOW PATHS

Type of Material to which bridge is attached	Metal	BRIDGE TYPE	
		Metal	Non-Metal
		Thermal Bridges in Sheet Metal Construction Method	Parallel Path
	Non-Metal	Zone Method	Parallel Path

3. For elements with internal metallic structures bonded on one or both sides to a metal skin or covering, the "Thermal Bridges in Sheet Metal Construction," the calculation procedure as specified in "Thermal Bridges in Sheet Metal Construction," Studies in Building Physics (Johannesson, Gudni. 1981. Division of Building Technology, Lund Institute of Technology, Lund, Sweden. Report of TVBH-3007) shall be used.
4. For elements other than those covered above, the zone method described in Chapter 23 of the ASHRAE Handbook, 1985 Fundamentals Volume shall be used. The formulas on pages 23.13-.14 shall be used for calculation.

E2: For envelope assemblies containing Non-metal Framing, the U_i shall be determined from results from one of the laboratory or field test measurements specified in Section 3108.2 or from the ASHRAE series parallel method. Formulas in Chapter 23, page 23.2 of the ASHRAE Handbook, 1985 Fundamentals Volume shall be used for these calculations.

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APPENDIX F

REFERENCE DATA FOR REPAIR, ALTERATION, ADDITION AND CHANGE OF USE OF EXISTING BUILDINGS

PART ONE-GUIDELINES FOR APPLICATION

F-101 Purpose

F-101.1 Intent of Article 32: The purpose of this guideline is to provide guidance to users of the Massachusetts State Building Code as to techniques of acceptable practice which can be used to assess the acceptability of various methods of meeting the intent of code provisions of Article 32 on a case-by-case basis. The purpose of the code provisions in Article 32 and this guideline is to allow the repair, alteration addition, and change of use of existing buildings without requiring the entire building to be brought up to new construction requirements, while still providing for the public health, safety and general welfare. The provisions of Article 32 and this guideline recognize that the provisions of the Massachusetts State Building Code for new construction reflect the latest improvements in materials, construction techniques, standards of living and safety and, therefor, may preclude the repair, alteration, addition, or change of use of existing buildings that have demonstrated their usefulness and safety.

F-102.0 Scope

F-102.1 Techniques: This guideline is intended to demonstrate techniques of analysis and compliance with Article 32 of the Massachusetts State Building Code in the repair, alteration, addition, and change of use of existing buildings.

F-103.0 Statement of Concept

F-103.1 General conditions: Conceptually, it is the intent of Article 32 and these guidelines to allow repair, alteration, addition, or change of use of existing buildings without meeting all new construction requirements under the following general conditions:

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1. all hazardous conditions must be corrected;
2. the existing building becomes the minimum performance standard; and
3. the degree of compliance of the building after changes must not be below that existing before the changes, except that nothing in this section will require compliance with requirements more stringent than that required for new construction.

F-104.0 Implementation

F-104.1 Framework: Implementation of the above concept requires that a framework be established for evaluating the condition of the building; determining the potential for modification; and establishing the acceptability of proposed changes.

F-104.2 Evaluation of existing building: Evaluation of existing conditions in a structure is required to determine the existence of any hazardous conditions, which must be corrected; and to provide a basis for evaluating the impact of the proposed changes on the performance of the building.

The following list of evaluation tools described in Sections F-104.2.1 through F-104.2.7 of this appendix can be used for determining the condition of the structure. However, this list is not necessarily complete and the use of other methods should not be precluded.

F-104.2.1 Available documentation of existing building: Prime sources of design information for existing buildings are the architectural and engineering drawings and specifications used in the construction of the building. Although the passing of time often obscures the identifies of depositaries of such documents, the following are likely prospects in attempting to locate such information:

1. If the building is currently in use, an individual or office responsible for its management may have retained drawings and specifications to facilitate maintenance. A building manager, resident engineer, superintendent, custodian, stationary engineer or plant engineer may be the most direct contact at the building site.
2. Other potential sources (especially if the building is not in use) include the original designer-architect or engineer.
3. The building department which issued the permit for construction may have documentation.
4. Documentation may have been retained by the general contractor or numerous subcontractors. This present the mason, carpenter, plumber, electrician, HVAC installer, steel erector, etc., as well as manufacturers of component parts, as potential sources of documentation.

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5. In the case of large corporations or government agencies, a separate contracting officer may have developed a technical file on the erection of a building.
6. In some cases, individual consultants are contracted to serve as "clerk-of-the-works" and pursue the inspection of a building project from start to finish with the keeping of a file likely.
7. Insurance companies sometimes maintain drawings or records of their insured buildings.
8. Historical or archaeological societies may have considered a building to be important enough to develop a file of documentation.

F-104.2.2 Field surveys: Having drawn upon available documentation to help evaluate a building's condition, such documentation may be augmented by on-site data acquired through field survey. The most obvious approach is to make use of detailed visual examination to confirm and/or alter any previously available information pertaining to the building.

F-104.2.3 Testing: Testing is a tool that may be used in evaluating the condition of a building or structure or parts thereof when other methods of evaluation will not suffice. Testing may be initiated voluntarily on the part of the permit applicant or may be required by the building official in the absence of approved rules as indicated in Section 1301.1 of the code. This section points out that "... the building official shall make or cause to be made the necessary tests and investigations, or he shall accept duly authenticated reports from recognized authoritative sources." The costs of all such tests are to be borne by the permit applicant and should, therefore, be required by the building official only when other methods of evaluation prove inadequate or insufficient. Such testing should be conducted by an approved testing agency under the supervision of a registered architect or engineer. The report of the tests shall be submitted to the building official and shall include the details of test procedures, references to any accepted test standards used, the results of the tests and any conclusions drawn from the test results.

F-104.2.4 Nondestructive testing: This includes techniques where the structural integrity of the building is not affected, such as the following:

1. analyzing various portions of the building to determine dimensions, types and condition of materials, etc.;
2. portable apparatus for impact testing;
3. load application short of failure to determine capacity of materials and components;
4. magnetic methods for detecting flaws in ferrous metal;
5. proximity magnetometers (locating rebars in concrete, concealed ferrous fasteners, etc.);

6. electronic means for measuring the sonic modulus of elasticity of concrete and masonry in assessing its soundness;
7. ultrasonic transmission or reflective methods in detecting flaws in various materials; and
8. x-ray or infrared-ray photographic techniques used to evaluate portions of elements whose integrity is questionable.

F-104.2.6 Destructive testing: In destructive testing a sample of the building could be removed and tested (e.g., concrete core), or components of the building could be reconstructed and tested in the laboratory.

F-104.2.7 Laboratory analysis: In some cases, tests can be performed in the laboratory. Such tests might include the following:

1. chemical or metallurgical test;
2. optical or electronic microscopic examination which can help identify and evaluate the soundness of materials where decay or other molecular degradation is involved;
3. conventional laboratory tests for determining physical properties (strength, ductility, absorption, solubility, permeability, stiffness, etc.; and/or
4. testing of a scale model of the building (computer model, wind tunnel model, etc.).

F-104.3 Evaluation of change in performance level: It is necessary to determine if the level of performance of the building after alteration is below that which existed before the change. The hazard level could be increased for certain attributes (such as fire safety) while decreased for other attributes (such as floor loads) for a given alteration. The evaluation of the change in hazard levels of each attribute can be accomplished using various tools singly or in combination as described below in Section 104.3.1 through 104.3.5.

F-104.3.1 Data on archaic systems: Performance data on architectural and structural systems being encountered in existing buildings in the Commonwealth are tabulated in part four of this appendix. This data can be compared to the proposed altered systems to determine if the performance is being adversely affected.

F-104.3.2 Compliance alternatives: Alternate solutions tabulated in part two of this appendix were developed from appeal data and from accepted practice. The list is not all-inclusive and should not preclude consideration of other alternatives.

F-104.3.3 Analysis methods: Analytical methods based on good engineering practice may be used to determine changes in performance levels.

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F-104.3.4 Test methods: Test procedures as discussed in Sections F-104.2.3 through F-104.2.6 of this appendix can be used to evaluate the performance of existing construction.

F-104.3.5 Professional judgement: Professional judgement based on previous experience with similar buildings should be used to the fullest extent possible.

PART TWO-SUGGESTED COMPLIANCE ALTERNATIVES

F-201.0 Purpose and scope

F-201.1 Purpose: The purpose of this reference is to assist the building official and those regulated by this code in judging the acceptability of compliance alternatives to specific code provisions required by the code.

F-201.2 Application: This reference contains generally acceptable compliance alternatives and examples. The examples are solely for the purpose of illustrating principles which can be applied to the solution of code compliance problems and are not necessarily acceptable under all circumstances. It is recognized that all building systems interact with each other. Therefore, any consideration of compliance alternatives must take into account all existing and proposed conditions to determine their acceptability. The principles applied can be used for the solution of similar compliance problems in other buildings and occupancy groups. Commentaries are provided where the philosophy in establishing the alternatives is not obvious. The examples were developed from appeal data and accepted practice. They are not all-inclusive and should not preclude consideration of other alternatives.

Note: It is anticipated that additional compliance alternatives will be added to this reference through the mechanism of appeal decisions and from results of research being conducted by various organizations in the field of relative performance of life safety systems.

F-202.0 Compliance alternatives for egress requirements

F-202.1 Number of exits

F-202.1.1 General compliance alternatives:

1. Provide connecting fire balconies.
2. Provide alternate egress facilities (windows, etc.).
3. Provide a fire escape.
4. Provide fire-rated areas of refuge.

F-202.1.2 Examples:

Example 1 involves a five-story "row house" of occupancy group B without a fire suppression system and with only one (1) means of egress.

Solution A. Add one (1) or more fire escapes as may be necessary to provide all tenants with reasonable access to two (2) means of egress in separate directions. Access to a street, public way or area of refuge shall be provided at the termination of the fire escape.

Solution B. Add connecting fire balconies across fire walls if the above solution is impractical due to construction difficulties.

Example 2 involves a building of group R-2 occupancy with an apartment in the basement. There is only one (1) means of egress from the basement.

Solution A. Provide egress windows in each apartment that comply with Article 8.

F-202.2 Travel Distance

F-202.2.1 General Compliance Alternatives:

1. Add detection system.
2. Add a partial fire suppression system.
3. Add smoke doors.
4. Increase fireresistance rating of corridor walls and doors.

F-202.2.2 Example: This example involves a four (4) story building of occupancy group R-2 without a fire suppression system. The length of exitway access travel is one hundred fifty (150) feet.

Solution A. Add a partial fire suppression system off the domestic water supply (if adequate) in the exit access corridor.

Solution B. Subdivide corridor into segments if less than one hundred (100) feet with smoke doors.

Solution C. If not required by other sections of the code, install smoke and fire detectors with audible alarms in the corridor.

Solution D. Increase the fireresistance rating of the exit access corridor from one (1) hour to two (2) hours and provide one-half hour ($\frac{1}{2}$) hour "B" label self-closing or automatic closing fire doors in all openings into the corridor.

F-202.3 Enclosure of exitways

F-202.3.1 General Compliance alternatives

1. Improve enclosure of exitway.
2. Add a partial fire suppression system.
3. Add a detection system.

F-202.3.2 Examples: This example involves a four (4) story row building of occupancy group R-2 with connecting fire balconies and an interior stair. The stair is enclosed with wood lath and plaster wood stud partitions and paneled doors.

Solution A. Cover partitions on the apartment side with 5/8" Type X gypsum wallboard or its equivalent. Replace or build up panel doors until minimum solid portion is one and three-eighths (1 3/8") and install self-closers.

Solution B. Provide a heat and smoke detection system in the stairwell with an alarm audible to all tenants. Provide self-closers on all stairwell doors.

Solution C. Provide a partial fire suppression system in the stairwell off the domestic water supply (if adequate). Provide self-closers on all stairwell doors.

F-202.3.3 Commentary: The above example, while pertaining to a four (4) story group R-2 building, can also be applied to other buildings of various heights and occupancies. The principle that the degree of compliance may not be reduced should be remembered. If the existing enclosure is of fireresistive construction, it must be maintained. The primary principle to remember, in the required enclosure of exitway, is that an enclosure must be provided, whether fireresistive or not, so as to provide a smoke barrier. The purpose of providing a smoke barrier is to prevent the passage of smoke from a fire on one (1) floor to the exitways and exit access corridors of other floors and thus render them unusable for egress. This principle is illustrated by solutions A, B, and C in the above example.

F-203.0 Compliance alternatives for fire hazards

F-203.1 Fire separations and partitions

F-203.1.1 General compliance alternatives:

1. Improve fire separation.
2. Add a fire suppression system.
3. Add a detection system.

F-203.1.2 Examples: Example 1 involves a three (3) story Type 3A building, of occupancy group M, on the first floor and occupancy group B on the second and third floors. The required separation is three (3) hours.

Solution A. Add a fire suppression system to the first and second floors.

Solution B. Add five-eighths (5/8) inch Type X gypsum wallboard or its equivalent to the underside of the second floor and install a system of smoke and heat detectors with audible alarms on the first and second floors.

Example 2 involves the separation between two (2) tenants of wood lath and plaster on a wood studs partition. The required separation is one (1) hour.

Solution A. Add five-eighths (5/8) inch Type X gypsum wallboard or its equivalent to the either side of the existing partition.

Example 3 involves a building of occupancy B with unrated exit access corridors.

Solution A. Install a partial fire suppression system in the exit access corridors.

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Solution B. Add five-eighths (5/8) inch Type X gypsum wallboard or its equivalent to either side of the corridor partition and install self-closers on all corridor doors.

Solution C. Install a smoke and heat detection system in the corridor with and alarm audible to all tenants on the floor and install self-closers on all corridor doors.

F-203.2 Openings and exterior wall protection

F-203.2.1 General compliance alternatives:

1. Add fire suppression system.
2. Improve fireresistance.
3. Remove or improve openings.

F-203.2.2 Examples: Example 1 involves a two (2) story Type 5B building, of occupancy M, on the first floor with the basement and upper floors used for storage. The distance between the building and the side lot line is five (5) feet and between it and the adjacent building is ten (10) feet. The adjacent building is of Type 5B construction and of occupancy group R-2. The former occupant was a grocery store; the new occupant is a hardware store.

Solution A. Install a deluge sprinkler system along the interior side of the wall affected.

Solution B. Add five-eighths (5/8) inch Type X gypsum wallboard to interior side of the wall affected.

Example 2 is the same as example 1 but with double-hung wood windows in affected wall.

Solution A. Remove windows and close opening with one (1) hour fireresistive construction.

Solution B. Remove windows and install fire windows.

Solution C. Install a deluge sprinkler system as in solution A to example 1.

PART THREE-DETAILED CLASSIFICATION OF OCCUPANCY BY HAZARD INDEX NUMBER AND USE GROUP

This part provides a more detailed guide for users of the code to determine hazard index numbers and use groups for various types of occupancies. It supplements Article 2 and Table 3204 contained in Article 32.

REFERENCE DATA FOR EXISTING BUILDINGS

**TABLE F-1
HAZARD INDEX AND USE GROUP CLASSIFICATION**

Use of Structure	Hazard Index No.	Use Group
Advertising Displays Manufacture including billboards	3	S-1
Airport or other aircraft landing or service facility (see also: Helicopter rooftop landing facility)	3	F
Amusement park, indoor	4	A-3
Animal		
Crematorium	3	<u>F-2</u>
Hospital, kennel, pound	2	B
Apartment (see Residences)		
Appliances		
Manufacture	3	<u>F-1</u>
Sales	3	M
Arenas	4	A-3
Asphalt		
Processing and products manufacture	8	H
Athletic equipment		
Manufacture	3	<u>F-1</u>
Sales	3	M
Auditoriums	<u>6</u>	<u>A-1 with stage</u>
	<u>5</u>	<u>A-1 without stage</u>
	<u>4</u>	<u>A-3</u>
Automobile and other motor vehicles		
Gasoline service station	<u>3</u>	<u>M</u>
Rental agency within a building	2	B
Repair	3	S-1
Repair incidental to auto sales		
with limitations	3	S-1
Sales within a building	3	M
Wrecking	3	F
Washing	3	S-1
Awning manufacturer	3	<u>F-1</u>
Baked goods shop	3	M
Bakeries	3	<u>F-1</u>
Banks	2	B
Banquet halls	5	A-3
Barber shops	2	B
Beauty shops	2	B

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TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Beverages		
Bottling	2	<u>F-1</u>
Manufacture		
Alcoholic	8	H
Less than 0.5% alcohol @ 60°	3	<u>F-1</u>
Bicycle		
Manufacture	3	<u>F-1</u>
Rental or repair conducted within a building	3	S-1
Sales	3	M
Billiard Parlor	4	A-3
Blacksmith shops	3	<u>F-1</u>
Blueprinting, etc. establishments	3	<u>F-1</u>
Boarding house	2	R-1 or R-2
Boats or ships		
Building or repair of boats	3	<u>F-1</u>
Bone distillation	3	<u>F-1</u>
Bowling alleys	4	A-3
Broom or brush manufacture	3	<u>F-1</u>
Building materials		
Wholesale business in roofed structures	3	M or S-1
Bus terminals or stations	4	A-3
Business schools or colleges	4,2 or other	<u>A-4, B or dependent upon use</u>
Camera and other photo equipment		
Manufacture except film sales	3	M
Sales	3	M
Canvas or canvas products		
Manufacture or repair	3	<u>F-1</u>
Carpet and rug		
Cleaning establishments	8 or 3	H, <u>F-1</u>
Manufacture or repair	3	<u>F-1</u>
Catering for outside consumption	3	<u>F-1</u>
Cemeteries		
Crematory in cemetery	3	<u>F-2</u>
Mausoleum, crypt, columbarium	1	S-2
Mortuary chapel in cemetery	4	A-4

REFERENCE DATA FOR EXISTING BUILDINGS

TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Ceramics products manufacture, including pottery, small glazed tile and similar items	3	<u>F-2</u>
Charcoal, fuel, briquettes, or lampblack manufacture	8	H
Chemicals		
Packaging	8 or 3	H or <u>F-1</u> depending on nature of material
Manufacture	8 or 3	H or <u>F-1</u> depending on nature of material
Churches or other places of worship	4	A-4
Circuses, temporary	4	A-3
Cleaning (see Drycleaning & dying; Laundries; Automobiles, washing)		
Clothing		
Manufacture	8 or 3	H or <u>F-1</u> depending nature of material
on		
Rental establishment	3	M
Retail sales	3	M
Tailoring, custom manufacture or repair (see also Feathers; Felt; Fur; Leather)	3	M
Clubs		
Private	4	A-3 without residence
Nightclubs (see Eating & drinking establishments)		
Coal, coke or tar products		
Manufacture	8	H
Colleges and Universities		
Classroom buildings	4	<u>A-3</u>
Dormitories	2	<u>R-2</u>
Fraternities or sororities	2	<u>R-2</u>
Community centers	4 or 2	<u>A-3, or B</u>
Convalescent homes (see Nursing homes)		
Convents	2	<u>R-2</u>
Cosmetics or toiletries manufacture	8	H

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TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Cotton ginning	8	H
Cotton wadding or linters manufacture	8	H
Courthouses	2 or 4	<u>B</u> or A-3
Crematoriums		
Animal	3	<u>F-2</u>
Human	3	<u>F-2</u>
Dance halls	7	A-2
Day care agencies	4	I-2 or <u>E</u>
Day nurseries	4	I-2
Dental offices (see Medical & dental)		
Department stores	3	M
Dormitories	2	R-1 or R-2
Dressmaking shops, custom	8	H
Drinking places (see Eating & drinking establishments)		
Drive-in restaurants	5	A-3
Drug stores	3	M
Dry cleaning and dyeing establishments	8 or 3	H or <u>F-1</u> depending on solvents used
Dwellings (see Residences)		
Eating or drinking establishments		
Lunchrooms, restaurants, cafeterias, etc., primarily enclosed	5	A-3
Drive-in	4	A-3
With entertainment or dancing	7	A-2
Electric		
Power or steam generating plants	3	<u>F-1</u>
Substation	3	<u>F-1</u>
Electrical appliances, bulbs, wiring, supplies, etc.		
Manufacture	3	<u>F-1</u>
Sales	3	M
Electronic components & supplies		
Manufacture or repair	3	<u>F-1</u>
Feathers		
Curing, dyeing, washing or bulk processing	8	H
Manufacturing exclusive of above	8	H

REFERENCE DATA FOR EXISTING BUILDINGS

TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Felt		
Curing, dyeing, washing or bulk processing	3	<u>F-1</u>
Products manufacture, exclusive of above	3	<u>F-1</u>
Fertilizer manufacture	8	H
Film, photographic, manufacture	3 or 8	<u>F-1</u> or H
Storage and studios	3 or 8	<u>F-1</u> or H
Fire stations	2	B
Fish processing	3	<u>F-1</u>
Florida shops	3	M
Food		
Product processing except meat & fish	3	<u>F-1</u>
Retail sales	3	M
Fraternities or sororities	2	R-1 or R-2
Funeral establishments	4	A-3
Fur		
Curing, dyeing, finishing, tanning	8	H
Products manufacture exclusive of above	3	<u>F-1</u>
Garage (see Parking garage)		
Garbage incineration or reduction	3	<u>F-1</u>
Gas		
Manufacture	8	H
Public utility stations for metering or regulating	2	<u>B</u>
Storage		
2500 cu. ft. or less	3	S-1
more than 2500 cu. ft.	8	H
Gasoline service station (see Automobiles)		
Gelatin manufacture	3	<u>F-1</u>
Generating plants, electric or steam	3	<u>F-1</u>
Gift shops	3	M
Glass products from previously manufactured	3	<u>F-2</u>
Glue manufacture	3	<u>F-1</u>
Golf		
Indoor courses or driving ranges	4	A-3
Gymnasiums	4	A-3
Grain storage	8	H
Hair Curing, dyeing, washing, bulk processing	3	<u>F-1</u>

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TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Product manufacture exclusive of above	3	<u>F-1</u>
Hardware		
Manufacture	3	<u>F-1</u>
Retail sales	3	M
Hat bodies manufacture	3	<u>F-1</u>
Helicopter landing facility, rooftop	3	S-1
Home occupations	2	B
Homes for the aged	4	I-2
Hosiery manufacture	3	<u>F-1</u>
Hospitals		
Including convalescent, nursing, or rest homes and sanitariums, provided custodial care is not provided for drug addicts, alcoholics, mentally ill or mentally deficient	4	I-2
For care of drug addicts, mentally ill, or mentally deficient	5	<u>I-3</u>
Research or teaching laboratories (see also Animal hospitals)	2	B
Hotels	2	<u>R-1</u>
Ice manufacturing (dry or natural)	3	<u>F-2</u>
Ice skating rinks	4	A-3
Incineration or reduction of garbage, offal, or dead animals	3	<u>F-1</u>
Industry uses (see specific items)		
Without resulting noise, vibration, special danger, hazard, dust, smoke, fumes, etc.	3	<u>F-2</u>
Other than above	3 or 8	<u>F-1</u> or H
Ink or inked ribbon manufacture	3	<u>F-1</u>
Jewelry	3	<u>F-1</u>
Kennels (see Animal)		
Laboratories		
Research laboratory not accessory to school or hospital	2	B
Scientific research or teaching laboratory, non-profit, accessory to school, or hospital, subject to limitations	2	B

REFERENCE DATA FOR EXISTING BUILDINGS

TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Laundries		
Hand laundry	2	B
Self service; pick-up and delivery station of laundry or dry cleaner	2	B
Steam laundries without limitations	3	<u>F-1</u>
Leather		
Curing, dyeing, finishing or tanning	3	<u>F-1</u>
Product manufacture exclusive of above	3	<u>F-1</u>
Libraries	4	A-3
Linoleum or oilcloth manufacture	3	<u>F-1</u>
Liquor sales, package	3	M
Luggage manufacture	3	<u>F-1</u>
Lumber (see Wood)		
Manufacturing	3 or 8	<u>F-1</u> or H
Matches manufacture	8	H
Mattress manufacture and renovation	3	<u>F-1</u>
Meat Markets	3	M
Slaughtering or packaging	3	<u>F-1</u>
Medical & dental offices	2	B
(see also Laboratories; Orthopedic & medical appliances; Hospitals)		
Meeting hall	4	A-3
Metals, manufacture	3	<u>F-2</u>
Reduction, refining or smelting	8	H
Monasteries	2	<u>R-2</u>
Motels	2	<u>R-1</u>
Motor freight stations (see trucking terminals)		
Museums	4	<u>A-3</u>
Musical instruments manufacture	3	<u>F-1</u>
Newspaper publishing	3	<u>F-1</u>
Newsstands	3	M
Novelty products manufacture	3	<u>F-1</u>
Nursing Homes	4	I-2
Offices	2	B
Oilcloth manufacture	3	<u>F-1</u>
Optical equipment or similar precision instruments manufacture	3	<u>F-1</u>
Orphanages	3	I-2

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TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Orthopedic or medical appliance manufacture	3	<u>F-1</u>
Paint, turpentine or varnish		
Manufacture	8	H
Spraying booths	8	H
Paper products manufacture	3	<u>F-1</u>
Parish houses	4	A-3
Parking garages		
<u>Group 1</u>	<u>3</u>	<u>S-1</u>
<u>Group 2</u>	<u>1</u>	<u>S-2</u>
Petroleum or petroleum products		
Refining	8	H
Storage	3	S-1
Pharmaceutical products manufacture	3	<u>F-1</u>
Photography studio	2	B
Plastics		
Product manufacture	8	H
Raw, manufacture	8	H
Police stations	2	B
Pool rooms	<u>4</u>	A-3
Post offices	2	B
Printing		
Plant	3	<u>F-1</u>
Printing or newspaper publishing	3	<u>F-1</u>
Prisons & other correctional or detention		
institutions	5	<u>I-3</u>
Pumping station or substation, water or sewage	<u>3</u>	<u>F-2</u>
Radio		
Sales	3	M
Studios with audience	5	A-1-B
Studios without audience	2	B
Railroad		
Freight terminal	3	S-1
Passenger station	4	A-3
Recreation		
Center, indoor	4	A-3
Community center building	4	A-3
Rectories	2	<u>R-2</u>

REFERENCE DATA FOR EXISTING BUILDINGS

TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Residences		
One-family	2	R-3, <u>or</u> R-4
Two-family	2	R-3, <u>or</u> R-4
Apartment	2	R-2
Temporary dwelling structure	2	R-3
Boarding or lodging house	2	R-1 or R-2
Dormitory	2	R-1 or R-2
Fraternity or sorority	2	R-1 or R-2
Hotel, motel apartment with accessory services	2	R-1
Convents, monasteries, rectories	2	<u>R-2</u>
Research laboratories (see Laboratories)		
Restaurant, lunch room, cafeteria or other establishments primarily for eating	5	A-3
Retail business	3	M
Stores with combustible or flammable goods constructing a high hazard	8	H
Rubber		
Manufacture (natural or synthetic), including tires, tubes, or similar products	8	H
Products (exclusive or processing) including washers, gloves, footwear bathing caps and the like	3	<u>F-1</u>
Sanatariums		
Not providing custodial care for drug addicts, alcoholics, mentally ill, or mentally deficient	4	I-2
Providing care for the above	5	<u>I-3</u>
Schools	4	<u>E</u>
Seminaries	4 or 2	A-4 & R-1
Settlement houses (depending on nature of activities)	4 or 2	A-3 or B
Sewage		
Disposal plant	3	<u>F-1</u>
Pumping station	3	<u>F-1 or F-2</u>
Shoddy manufacture	8	H
Shoes Manufacture	3	<u>F-1</u>

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TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Repair shop	2	B
Silverware manufacture, plate or sterling	3	<u>F-1</u>
Size manufacture	3	A-3
Skating rinks	4	A-3
Soap and detergents		
Manufacturing, including fat rendering	8	H
Packaging	3	<u>F-1</u>
Solvent extracting	8	H
Sporting or athletic goods		
Manufacture	3	<u>F-1</u>
Stores	3	M
Stables	3	S-1
Stadiums	4	A-5
Wholesale business, including accessory storage other than flammable liquids, gases and explosives, in roofed structures	3 or 1	S-1 or S-2 depending on nature of materials
Stores (see Retail stores; or specific items)		
Tailor shops, custom	2	B
Tanning (see leather; Fur)		
Taxidermist shops	3	M
Telephone exchanges		
Automatic	2	B
Non-automatic	2	B
Television		
Sales	3	M
Studios	3	M
	6	A-1 with scenery
	5	A-1 no scenery
	2	B no audience
Textiles		
Manufacture, including knit & yard goods, thread or cordage, spinning, weaving, dyeing & printing, shoddy manufacture	3	<u>F-1</u>

REFERENCE DATA FOR EXISTING BUILDINGS

TABLE F-1 (continued)
HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Theaters	6	A-1 with scenery
	5	A-1 no scenery, motion picture
Tires, manufacture	8	H
Tobacco products manufacture including curing	3	<u>F-1</u>
Tools & hardware		
Manufacture	3	<u>F-1</u>
Sales	3	M
Toys		
Manufacture	3	<u>F-1</u>
Trailer park (see Mobile homes)		
Truck		
Repairs	3	S-1
Sales	3	M
Trucking terminals	3	S-1
Turpentine manufacture	8	H
Warehouses	8,3,or1	H,S-1,orS-2 depending on nature of materials
Waterpumping stations	2	<u>F-2</u>
Wax products manufacture	8	H

PART FOUR-ARCHAIC CONSTRUCTION SYSTEMS

F-401.0 Purpose and Scope

F-401.1 Purpose: The purpose of this part of Appendix F is to assist the building official and those regulated by this code in evaluating the properties of archaic construction systems.

F-401.2 Scope: This part of Appendix F contains data on construction systems no longer in general use but which may be encountered in older existing buildings. It is meant to be used for assessing existing conditions when evaluating how proposed changes will impact upon the performance of the building.

F-401.3 Application: In any given problem, all available data should be collected and professional judgement exercised in arriving at decisions. Evaluative judgment should be used when test data does not exist or when applying the data contained in this standard.

F-402.0 Archaic fireresistive systems

F-402.1 General: This part of Appendix F contains a list of fireresistive materials and construction which are not necessarily currently in common use. Some of the hourly ratings contained in the listing predate ASTM E-119 that is in current use. The hourly ratings may be higher or lower if tested according to ASTM E 119. In addition to the data contained herein, see Report BMS92, Building Materials and Structures, dated October 7, 1942, National Bureau of Standards. The data listed below is extracted from the Boston Building Code, circa 1943.

F-402.2 Fireresistive materials and construction

F-402.2.1 Minimum qualities: Materials, to be given the fireresistive ratings specified in this part, shall have the following minimum qualities set forth in Sections F-402.2.2 through F-402.2.19.

F-402.2.2 Class 1 concrete: Concrete of Class 1 shall be so proportioned as to have a strength of at least fifteen hundred (1500) pounds per square inch (psi) and the coarse aggregate shall consist of limestone, trap rock, blast furnace slag, cinders containing not more than twenty (20) per cent of combustible material, burned clay or shale.

F-402.2.3 Class 2 concrete: Concrete of Class 2 shall be so proportioned as to have a strength of at least fifteen hundred (1500) pounds psi, the coarse aggregate consisting of sandstone, granite, quartzite, siliceous gravel or other similar material not over one (1) inch in size.

F-402.2.4 Masonry: Masonry shall be laid in lime-cement or cement mortar, or approved masonry cement mortar, except that masonry of gypsum tile shall, and masonry of structural clay tile may, be laid in gypsum mortar. Masonry shall be thoroughly bonded by breaking joints in successive courses or by the use of metal ties.

F-402.2.5 Brick: Brick shall be burned clay or shale, concrete or sand-lime brick of Grade C or better.

F-402.2.6 Stone: Stone shall be limestone, marble, slate or equally fireresistive natural stone. Sandstone, granite or other stone which, because of its crystalline

structure or for other reason, is less fireresistive, shall not be considered fire protection for structural metal, but may be used in a masonry wall not less than twelve (12) inches thick required to have fireresistance. Stone masonry shall have the same fireresistive rating as brick masonry.

F-402.2.7 Cast stone: Cast stone masonry shall have the same fireresistive rating as brick masonry.

F-402.2.8 Concrete blocks: Concrete blocks, whether solid or hollow, shall have as coarse aggregate limestone, trap rock, blast furnace slag, cinders containing not more than twenty (20) per cent of combustible material, burned clay or shale.

F-402.2.9 Structural clay tile: Structural clay tile shall conform to the specifications for load-bearing tile, floor tile or partition tile. Where partition tile is specified load-bearing tile may be used.

F-402.2.10 Gypsum: Gypsum tile or pre-cast gypsum concrete, whether solid or hollow, shall conform to Standard Specifications for Gypsum Partition Tile or Block of the American Society for Testing Materials and shall not contain more than three (3) per cent by weight of wood or other combustible binder or filler.

F-402.2.11 Gypsum concrete: Gypsum concrete shall not contain more than twelve and one-half (12½) percent by weight of wood or other combustive binder or filler and shall have a compressive strength of at least five hundred (500) psi. It shall not be used where exposed to the elements.

F-402.2.12 Lath: Expanded metal or wire lath as a base or reinforcement for plastering shall weigh not less than two and two-tenths (2.2) pounds per square yard and shall have not less than two and one-half (2½) meshes per inch.

F-402.2.13 Metal mesh for masonry: Metal mesh reinforcement specified for masonry fire protection of structural metal shall consist of wire lath strips the full thickness of the masonry, laid in the beds thereof, or its approved equivalent.

F-402.14 Metal mesh for concrete: Metal mesh reinforcement specified for concrete fire protection of structural metal shall consist of wire mesh weighing not less than one and one-half (1½) pounds per square yard with wire spaced not over four (4) inches, or not less than No. 11 gauge steel wire spaced not over four (4) inches apart, or its approved equivalent.

F-402.2.15 Cement plaster: Cement plaster shall be proportioned of on (1) part Portland cement, and not more than two (2) parts of sand measured by volume dry and loose to which may be added lime putty or hydrated lime not exceeding fifteen (15) per cent of the cement.

F-402.2.16 Gypsum plaster: Gypsum plaster, except where otherwise specified, may contain sand, not in excess of three (3) times the weight of the gypsum.

F-402.2.17 Lime plaster: Lime plaster shall consist of a mixture of one (1) part lime, not over three (3) parts sand, and water.

F-402.2.18 Pneumatically projected mortar: Pneumatically projected mortar made of Portland cement, sand and water shall be rated for fire protection the same as Class 1 concrete.

F-402.2.19 Concrete fill: Concrete fill, where specified in this appendix in connection with hollow masonry units shall consist of Class 1 or Class 2 concrete poured in the hollow spaces of the units as they are laid.

F-402.2.20 Reinforced concrete: Portland cement concrete or gypsum concrete poured in place as fire protection for beams, trusses and other horizontal or inclined members of structural steel and pneumatically projected mortar applied to structural steel as fire protection shall be reinforced with metal mesh reinforcement. Concrete protection for vertical columns of structural metal shall have reinforcing consisting of No. 5 wire spaced not over eight (8) inches apart or its equivalent. Reinforcement shall be wrapped around the structural member and so arranged as to be completely embedded in the fire protection material and to ensure its integrity.

F-402.2.21 Reinforced plaster: Plaster used as fire protection or to resist the spread of fire shall be reinforced with metal lath, except plaster less than one (1) inch thick or masonry or concrete.

F-402.2.22 Replacement material: In the protection of structural metal including reinforcement, one-half ($\frac{1}{2}$) inch of cement or gypsum plaster may replace an equal thickness of poured concrete or pneumatically projected mortar as protective material; and one (1) inch of cement or gypsum plaster reinforced with metal lath may replace an equal thickness of poured concrete, pneumatically projected mortar or masonry protection.

F-402.2.23 Plaster: Where plaster is required without other specification, it shall consist of one-half ($\frac{1}{2}$) inch of cement or gypsum plaster, except that only gypsum plaster shall be used on gypsum masonry.

F-402.2.24 Thickness: In this appendix, except where otherwise specifically stated, the thickness given in a list of materials applies to the next following item only, and not to the total thickness where additional materials are specified.

F-402.2.25 Embedding limitations: Pipes, wires, conduits and ducts shall not be embedded in or placed behind the fire-protective materials required for the

protection of structural steel or iron except as otherwise provided in this paragraph. Above fire-protective hung ceilings and within the enclosed space in building of Type 1 and Type 2 construction within which, other than the enclosure, fire protection of steel is not required, pipes, wires, conduits and ducts may be placed, provided they are so arranged and so secured that they will not, either by expanding in the event of fire, or otherwise impair, the effectiveness of the enclosing protective materials. Electric conduits and wires and gas pipes may be embedded in concrete or masonry fire protection of structural steel where the protective material is reinforced with wire mesh, provided they shall have protective covering except over the tops of beams and girders, at least as thick as required for the steel.

F-402.2.26 Damage protection: In factories, garages, warehouses and other buildings in which the fire-protective covering required for steel or iron columns may be damaged by the movement of vehicles, materials or equipment, such covering shall be protected by metal or other material in a manner satisfactory to the building official.

F-402.2.27 Firestopping: Firestopping shall mean the stopping off or enclosure at the ends and wherever else specified of the spaced between studs of partitions, joists of floors and roofs and other similar spaces to prevent drafts of air and the communication of fire from one (1) such space to another. Fire-stopping shall consist of wood not less than one and one-half (1½) inches thick, of sheet metal not less than No. 24 gauge or of masonry, or a combination of such materials. Firestopping shall be tightly fitted in the space to be filled, about pipes, wires and ducts and, if cut or disturbed in the placement of pipes, wires and ducts, shall be repaired.

F-402.3 Fire protection of steel columns

F-402.3.1 Protective thickness: Structural steel columns required to have fire protection of a given rating shall be covered on all sides with protective material having not less than the thickness necessary for the required rating. Except where "no fill" is specified, re-entrant and other accessible spaces behind the specified outer protection shall be filled with concrete or brick masonry or the material of the outer protection.

F-402.3.2 Fireresistance rating: Materials shall be assumed to afford to steel columns fire protection of the rating indicated in the following Sections F-402.3.3 through F-402.3.6:

F-402.3.3 Four (4) hour rating:

1. Two (2) inches Class 1 concrete.
2. Three (3) inches Class 2 concrete, metal mesh reinforcement.
3. Three and one-half (3½) inches brick masonry.

4. Two (2) layers two (2) inch structural clay partition tile masonry, metal mesh in beds.
5. Two (2) inches structural clay partition tile masonry, concrete fill, metal mesh in beds, three-fourths (3/4) inch gypsum plaster.
6. Four (4) inches structural clay partition tile masonry, concrete fill, metal mesh in beds, five-eighths (5/8) inch lime plaster.
7. Four (4) inches structural clay partition tile or concrete block masonry, concrete fill, plaster.
8. Three (3) inches hollow gypsum tile masonry and plaster.
9. Two (2) inches gypsum concrete, metal mesh reinforcement.
10. Two (2) inches solid gypsum tile masonry and plaster.
11. Three (3) inches solid cinder concrete block masonry and plaster.
12. Four (4) inches hollow cinder concrete block masonry and plaster

F-402.3.4 Three (3) hour rating:

1. One and three-fourths (1 3/4) inches Class 1 concrete.
2. Two (2) inches Class 2 concrete, metal mesh reinforcement.
3. Two (2) inches gypsum concrete.
4. Two (2) inches solid cinder concrete block masonry and plaster.
5. Two (2) inches structural clay partition tile masonry, concrete fill.
6. Four (4) inches structural clay partition tile masonry, concrete fill, metal mesh in beds, five-eighths (5/8) inch lime plaster.

F-402.3.5 Two (2) hour rating:

1. One and one-half (1½) inches Class 1 concrete.
2. Two (2) inches Class 2 concrete, metal mesh reinforcement.
3. One (1) inch Class 1 or Class 2 concrete encased in standard weight steel or wrought iron pipe.
4. Two (2) inches structural clay partition tile masonry and plaster.
5. Two (2) layers plaster, each on metal lath, with three-fourths (3/4) inch air space between, two (2) inches total thickness.
6. Two (2) inches gypsum concrete.
7. Two (2) inches solid or three (3) inches hollow gypsum tile masonry.

F-402.3.6 One (1) hour rating:

1. One (1) inch Class 1 concrete.
2. One and one-half (1½) inches Class 2 concrete with metal mesh reinforcement.
3. Two and one-fourth (2¼) inches brick masonry.
4. Two (2) inches structural clay partition tile or concrete block masonry.
5. One (1) inch cement or gypsum plaster on metal lath.

F-402.3.7 Thickness: The thickness of protection on the outer edges of lugs or brackets need not exceed one (1) inch.

F-402.4 Fire protection of cast iron columns

F-402.4.1 Protective thickness: Cast iron columns required to have fire protection of a given rating shall be covered on all sides with protective materials having not less than the thickness necessary for the required rating. Re-entrant spaces, if any on the exterior of cast iron columns, and other accessible spaces behind the specified protection, shall be filled with Class 1 concrete or brick masonry or the material of the outer protection.

F-402.4.2 Fire-resistance rating: Materials shall be assumed to afford to cast iron columns fire protection of the rating indicating in the following Sections F-402.4.3 through F-402.4.5:

F-402.4.3 Four (4) hour rating: Cast iron columns shall not be used where the protection of a four (4) hour rating is required.

F-402.4.4 Three (3) hour rating:

1. Two (2) inches Class 2 concrete.
2. Three (3) inches Class 2 Concrete, metal mesh reinforcement.
3. Two (2) inches structural clay partition tile or concrete block masonry concrete fill.
4. One and one-half (1½) inches cement or gypsum plaster on metal lath and metal furring to form one-half (½) inch air space.
5. One and one-half (1½) inches Class 1 concrete.
6. Two (2) inches Class 2 concrete with metal mesh reinforcement.

F-402.4.5 One (1) hour rating:

1. One (1) inch Class 1 concrete.
2. One and one-half (1½) inches Class 2 concrete with metal mesh reinforcement.
3. One (1) inch cement or gypsum plaster on metal lath.

F-402.5 Fire protection of steel in reinforced concrete columns

F-402.5.1 Protection thickness: The main steel reinforcement, including spiral reinforcement and ties larger than one-half ($\frac{1}{2}$) inch, in reinforced concrete columns required to have fire protection of a given rating shall be covered with concrete having not less than the thickness listed in this section for the rating indicating in the following Sections F-402.5.2 through F-402.5.6:

F-402.5.2 Four (4) hour rating:

1. One and one-half ($1\frac{1}{2}$) inches Class 1 concrete.
2. Two (2) inches Class 2 concrete.

F-402.5.3 Three (3) hour rating: One and one-half ($1\frac{1}{2}$) inches Class 1 or Class 2 concrete.

F-402.5.4 Two (2) hour rating:

1. One (1) inch Class 1 concrete.
2. One and one-half ($1\frac{1}{2}$) inches Class 2 concrete.

F-402.5.5 One (1) hour rating: One (1) inch Class 1 or Class 2 concrete.

F-402.5.6 Ties less than one-half ($\frac{1}{2}$) inch: The thickness of protection on column ties not larger than one-half ($\frac{1}{2}$) inch may be one-half ($\frac{1}{2}$) inch may be one-half ($\frac{1}{2}$) inch thinner than that listed above.

F-402.6 Fire protection of steel beams, girders, and trusses

F-402.6.2 Protective thickness: Steel beams, girders and trusses or the members of trusses, required to have fire protection of a given rating, shall be covered on all sides with material having not less than the thickness necessary for the required rating.

F-402.6.3 Four (4) hour rating

1. Two (2) inches Class 1 concrete.
2. Three (3) inches Class 2 concrete.
3. Three (3) inches structural clay partition tile or concrete block masonry and plaster.
4. Three (3) inches hollow gypsum tile masonry and plaster.
5. Two (2) inches gypsum concrete.
6. Two (2) inches solid gypsum tile masonry and plaster.

F-402.6.4 Three (3) hour rating

1. One and three-quarters (1 3/4) inches Class 1 concrete.
2. Two and one-half (2½) inches Class 2 concrete.
3. Two (2) inches gypsum concrete.
4. Two (2) inches structural clay partition tile, or concrete block masonry and plaster.
5. Two (2) inches solid, or three (3) inches hollow gypsum tile masonry.

F-402.6.5 Two (2) hour rating

1. One and one-half (1½) inches of Class 2 concrete.
3. Two (2) inches gypsum concrete.

F-402.6.6 One (1) hour rating

1. One (1) inch Class 1 concrete.
2. One and one-half (1½) inches Class 2 concrete.
3. Seven-eighths (7/8) inch or cement or gypsum plaster on metal lath.

F-402.7 Fire protection of steel in reinforced concrete beams

F-402.7.1 Protective thickness: The main steel reinforcement, including stirrups larger than one-half (½) inch, in reinforced concrete beams, girders and trusses, including the ribs of reinforced concrete ribbed floors or roofs where one (1) or both sides of the ribs, in addition to the soffit, are exposed to fire, required to have fire protection of a given rating, shall be covered on all sides with concrete having not less than the thickness listed in this section for the required rating. Where a reinforced concrete floor or roof has a flush ceiling formed with approved permanent masonry filler between ribs, the reinforcement shall have the protection required for reinforcing steel of floors and roofs in Section F-402.8.

F-402.7.2 Four (4) hour rating:

1. One and one-half (1½) inches Class 1 concrete.
2. Two (2) inches Class 2 concrete.

F-402.7.3 Three (3) hour rating: One and one-half (1½) inches Class 1 or Class 2 concrete.

F-402.7.4 Two (2) hour rating:

1. One (1) inch Class 1 concrete.
2. One and one-half (1½) inches Class 2 concrete.

F-402.7.5 One (1) hour rating: One (1) inch Class 1 or Class 2 concrete.

F-402.7.6 Stirrups less than one-half ($\frac{1}{2}$) inch: The thickness of protection on stirrups not larger than one-half ($\frac{1}{2}$) inch may be less than that listed by not more than one-half ($\frac{1}{2}$) inch.

F-402.8 Fire protection of steel reinforcing in floors and roofs.

F-402.8.1 Protection thickness: The steel reinforcement in reinforced concrete floors and roofs with flush or plane ceiling, such that the exposure to fire is on the soffit only, required to have fire protection of a given rating, shall be covered with concrete having not less than the thickness listed in this section for the required rating. In floors or roofs having reinforced concrete ribs where the concrete surrounding the steel reinforcement is exposed to fire on one (1) or both sides in addition to the soffit, such reinforcement shall have the protection specified in Section F-402.7 for steel in reinforced concrete beams.

F-402.8.2 Four (4) hour rating:

1. One (1) inch Class 1 concrete.
2. One and one-fourth ($1\frac{1}{4}$) inches Class 2 concrete.

F-402.8.3 Three (3) hour rating: One (1) inch Class 1 or Class 2 concrete.

F-402.8.4 Two (2) hour rating:

1. Three-fourths ($\frac{3}{4}$) inch Class 1 concrete.
2. One (1) inch Class 2 concrete.

F-402.8.5 One (1) hour rating: Three-fourths ($\frac{3}{4}$) inch Class 1 or Class 2 concrete.

F-402.9 Fireresistive floor and roof construction

F-402.9.1 Protective thickness: Floors and roofs required to have resistance of a given rating to the spread of fire shall have such thickness of the materials of which it is constructed, as shall be necessary for the required rating, and structural metal forming a part of such floors or roofs shall have protection against fire of such required rating. Floors and roofs required to have two (2) hour or longer resistance to fire be constructed of noncombustible materials. Granolithic, burned clay tile, ceramic tile or other similar incombustible floor finish of a given thickness may be substituted for an equal thickness, and sand, cinder or other incombustible filling material, with or without embedded wooden screeds, may be substituted for two-thirds ($\frac{2}{3}$) its thickness, of the floor or roof construction material specified in this

section, provided that such floors and roofs shall have adequate thickness for structural purposes.

F-402.9.2 Fireresistance rating: Floor or roof construction shall be assumed to afford resistance to the spread of fire of the rating indicated in the following Sections F-402.9.3 through F-402.9.6:

F-402.9.3 Four (4) hour rating

1. Four (4) inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Four (4) inches solid masonry arches or slabs.
3. Four (4) inches structural clay floor tile masonry arches or slabs with top covering of not less than two (2) inches of solid masonry or reinforced concrete.
4. Five (5) inches combination reinforced Portland cement concrete slab consisting of permanent fillers of concrete block, gypsum or structural clay tile and one and one-half (1½) inches of concrete topping; but if structural clay partition tiles are used for fillers, they shall be plastered on the soffit.

F-402.9.4 Three (3) hour rating

1. Three (3) inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Three (3) inches solid masonry arches or slabs.
3. Four (4) inches structural clay floor tile masonry, arches or slabs with top covering of not less than one and one-half (1½) inches of solid masonry or reinforced concrete.
4. Four (4) inches combination reinforced Portland cement concrete slab consisting of permanent fillers of concrete block, gypsum or structural clay tile and one (1) inch concrete topping; but if structural clay partition tiles are used for fillers, they shall be plastered on the soffit.

F-402.9.5 Two (2) hour rating

1. Two and one-half (2½) inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Two and one-half (2½) inches solid masonry arches or slabs.
3. Three (3) inches structural clay floor tile masonry, arches or slabs with top covering of not less than one (1) inch of solid masonry or reinforced concrete.

F-402.9.6 One (1) hour rating

1. Three (3) inches structural clay floor tile masonry, arches or slabs with all joints thoroughly filled with cement or gypsum mortar.
2. Wood floor or roof construction with joists not less than one and five-eighths (1 5/8) inches in least dimension, firestopped, double board floor, approved asbestos felt between lay of boards, and with a ceiling of at least three-quarters (3/4) inch cement or gypsum plaster on metal lath.
3. Steel beams or steel joists not more than thirty-six (36) inches apart on centers with noncombustible floor and a ceiling of at least three-quarters (3/4) inch cement or gypsum plaster on metal lath furring.

F-402.10 Fireresistive ceiling construction

F-402.10.1 Protective thickness: Ceilings required to afford fire protection of a given rating to the floor or roof framing under which it is supported shall be of fireresistive materials of at least the thickness necessary for the given rating. A fireresistive ceiling and all hangers and fastenings necessary for its support to the protected framing shall be of noncombustible materials. It shall be capable of sustaining its own weight without exceeding allowable stresses. Metal reinforcement in such a ceiling shall be protected from fire as specified in Section F-402.8 for reinforcing in a floor.

F-402.10.2 Fireresistance rating: Ceiling construction shall be assumed to afford to floor or roof framing fire protection of the rating indicated in the following Sections F-402.10.3 through F-402.10.6.

F-402.10.3 Four (4) hour rating

1. Two and one-half (2½) inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Two (2) inches precast reinforced gypsum concrete, plastered.

F-402.10.4 Three (3) hour rating

1. Two (2) inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Two (2) inches precast reinforced gypsum concrete, lapped or rabbeted joints.

F-402.10.5 Two (2) hour rating: One and one-half (1½) inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.

F-402.10.6 One (1) hour rating: Three quarter (3/4) inch cement or gypsum plaster on metal lath.

F-402.11 Fireresistive bearing walls and partitions

F-402.11.1 Protective thickness: Bearing walls and partitions required to have resistance to fire or the spread of fire of a given rating shall be constructed of fireresistive materials and shall have at least the thickness necessary for the required rating. Walls required to have two (2) hour or longer rating shall be of noncombustible materials. Steel reinforcement in reinforced concrete walls shall have the same protection for the given rating as is required in Section F-402.9 for floors.

F-402.11.2 Fireresistance rating: Bearing walls and partitions shall be assumed to have resistance to fire and the spread of fire of the rating indicated in the following Sections F-402.11.3 through F-402.11.6:

F-402.11.3 Four (4) hour rating:

1. Eight inches solid brick masonry.
2. Twelve (1) inches hollow wall of brick masonry, minimum eight (8) inch masonry thickness.
3. Twelve (12) inches structural clay load-bearing tile masonry with two (2) units and not less than three (3) cells in the thickness of the wall.
4. Eight (8) inches structural clay load-bearing tile masonry with one (1) unit and not less than two (2) cells in the thickness of the wall, plastered both sides.
5. Twelve (12) inches concrete block masonry with one (1) unit and not less than two (2) cells in the thickness of the wall.
6. Eight (8) inches one (1) piece concrete block masonry with shells and webs at least one and one-half (1½) inches thick, plastered both sides.
7. Twelve (12) inches total thickness of brick masonry facing bonded to structural clay load-bearing tile masonry backing.
8. Eight (8) inches solid concrete.
9. Six (6) inches solid reinforced concrete.
10. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of four (4) hour rating, with panel filling as specified in Section F-402.12 for a nonbearing wall of four (4) hour rating.

F-402.11.4 Three (3) hour rating:

1. Eight (8) inches structural clay load-bearing tile masonry with two (2) units and not less than four (4) cells in the thickness of the wall.
2. Twelve (12) inches structural clay load-bearing tile masonry with one (1) unit and not less than three (3) cells in the thickness of the wall.

3. Eight (8) inches one (1) piece concrete block masonry with shells and webs not less than one and one-half (1½) inches thick, plastered both sides.
4. Eight (8) inches one (1) piece concrete block masonry with shells and webs not less than two (2) inches thick.
5. Five (5) inches solid reinforced concrete.
6. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of three (3) hour rating, with panel filling as specified in Section F-402.12 for a nonbearing wall of three (3) hour rating.

F-402.11.5 Two (2) hour rating:

1. Eight (8) inches structural clay load-bearing tile masonry with not less than three (3) cells in the thickness of the wall.
2. Eight (8) inches concrete block masonry with shells and webs not less than one and one-half (1½) inches thick.
3. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of two (2) hour rating, with panel filling as specified in Section F-402.12 for a nonbearing wall of two (2) hour rating.

F-402.11.6 One (1) hour rating:

1. A steel or wooden stud bearing wall covered on both sides with one (1) inches cement or gypsum plaster on metal lath, firestopped if of wood.
2. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of one (1) hour rating, with panel filling as specified in Section F-402.12 for a nonbearing wall of one (1) hour rating.

F-402.12 Fireresistive nonbearing walls and partitions

F-402.12.1 Protective thickness: Nonbearing walls and partitions required to have resistance to fire and the spread of fire of a given rating shall be constructed of fireresistive materials and shall have at least the thickness necessary for the required rating. Walls required to have two (2) hour or longer rating shall be of incombustible materials. Steel reinforcement in reinforced concrete walls shall have the same protection for the given rating as is required in Section F-402.8.

F-402.12.2 Fireresistance rating: Nonbearing walls and partitions shall be assumed to have resistance to fire and the spread of fire of the rating indicated in the following Sections F-402.12.3 through F-402.12.6:

F-402.12.3 Four (4) hour rating:

1. Eight (8) inches solid brick masonry.
2. Three and one-half (3½) inches solid brick masonry, plastered both sides.

3. Six (6) inches structural clay load-bearing tile, plastered both sides.
4. Six (6) inches solid concrete.
5. Four (4) inches solid reinforced concrete.
6. Any wall which, as a bearing wall, has a three (3) hour or four (4) hour rating in Section F-402.11, except the steel or reinforced concrete frame bearing wall.

F-402.12.4 Three hour rating:

1. Three and one-half (3½) inches solid brick masonry.
2. Four (4) inches structural clay load-bearing tile, plastered both sides.
3. Four (4) inches solid concrete.
4. Three (3) inches reinforced concrete.
5. Any wall which, as a bearing wall, has a two (2) hour rating in Section F-402.11 except the steel or reinforced concrete frame bearing wall.

F-402.12.5 Two hour rating:

1. Three (3) inches gypsum tile masonry plastered both sides except in exterior walls.
2. Eight (8) inches structural clay partition tile masonry, plastered both sides.
3. Eight (8) inches structural clay load-bearing tile, with three (3) cells in the thickness of the wall.
4. Two and one-half (2½) inches solid cement or sanded gypsum plaster on metal lath and noncombustible studding.
5. Three (3) inches total thickness of hollow wall, three-quarter (¾) inch cement or gypsum plaster on metal lath and noncombustible studding.
6. Three (3) inches total thickness of hollow wall, three-quarter (¾) inch cement or gypsum plaster on metal lath and wooden studding, firestopped.

F-402.13 Fireresistive doors

F-402.13.1 General: Doors which are required to be fire doors, fireresistive doors, or of fireresistive construction shall conform to the requirements of this section and Section F-402.14

F-402.13.2 Classification: Fire doors shall be classified for the purposes of this code as Class A, Class B, and Class C.

F-402.13.3 Class A fire doors: Class A fire doors shall be doors of the following construction and as specified in Section F-402.14:

1. Tin-clad, three (3) ply wood core, sliding.
2. Tin-clad, three (3) ply wood core, swinging single leaf, doorway not over six (6) feet wide.
3. Tin-clad, three (3) ply wood core, swinging in pairs, doorway not over (4) feet wide.
4. Hollow metal, swinging single leaf, doorway not over four (4) feet wide.
5. Hollow metal, swinging in pairs, doorway not over eight (8) feet wide.
6. Sheet metal, sliding, single, doorway not over ten (10) feet wide.
7. Sheet metal, sliding in pairs, doorway not over twelve (12) feet wide.
8. Sheet metal, swinging single leaf, doorway not over (6) feet wide.
9. Sheet metal, swinging in pairs, doorway not over ten (10) feet wide.
10. Steel rolling doorway not over twelve (12) feet wide.
11. Steel plate, doorway not over four (4) feet wide.
12. Any other construction equal or superior to a tin-clad three (3) ply wood core door in a standard fire test, for resistance to fire, the spread of fire and smoke, and transmission of heat.

F-402.13.4 Class B fire doors: Class B fire doors shall be doors of the following construction and as specified in Section F-402.14:

1. Tin-clad, three (3) ply wood core.
2. Tin-clad, two (2) ply wood core, sliding, doorway not over ten (10) feet wide.
3. Tin-clad, two (2) ply wood core, swinging single leaf, doorway not over six (6) feet wide.
4. Tin-clad, two (2) ply wood core, swinging in pairs, doorway not over (10) feet wide.
5. Hollow metal, sliding, doorway not over eight (8) feet wide.
6. Metal-clad, paneled, swinging single leaf, doorway not over three (3) feet wide.
7. Metal-clad, paneled, swinging in pairs, doorway not over six (6) feet wide.
8. Any other construction equal or superior to a tin-clad two (2) ply wood core door in a standard fire test, for resistance to fire, the spread of fire and smoke, and transmission of heat.

F-402.13.5 Class C fire doors: Class C Fire doors shall be doors of the following construction and as specified in Section F-402.14:

1. Metal-clad, paneled, swinging single leaf, doorway not over four (4) feet wide.
2. Metal-clad, paneled, swinging in pairs, doorway not over eight (8) feet wide.

F-402.13.6 Substitution: A Class A door may be used where Class B or Class C is specified; a Class B door may be used where Class C is specified. Two (2) Class B or Class C doors on opposite sides of the wall may be used where a single Class A or Class B door is specified.

F-402.13.7 Overlap: Fireresistive doors, when closed, shall completely cover the doorways in the walls and partitions or the openings in the floors or roofs to which they are fitted. A swinging fire door shall either overlap both jambs and the head of the opening not less than four (4) inches or be fitted to a fireresistive frame with a rabbet the full thickness of the door and with not less than one half ($\frac{1}{2}$) inch overlap on the door. A sliding fire door, except in enclosures about passenger elevators, shall overlap both jambs and the head of the opening not less than four (4) inches. A sliding fire door in an enclosure about a passenger elevator shall overlap jambs, head and adjoining panels not less than one half ($\frac{1}{2}$) inch. Fire doors shall fit closely at the floor with clearance of not over one quarter ($\frac{1}{4}$) inch.

F-402.13.8 Thresholds: In buildings with combustible floors, doorways required to have fire doors shall have noncombustible thresholds the full thickness of the wall, extending at least four (4) inches from the face of the wall where a door is hung and extending laterally at least six (6) inches behind each jamb of the doorway. Thresholds may be flush with the floor.

F-402.13.9 Rabbeted frame: The rabbeted frame of a swinging fire door shall be constructed of structural steel built into the concrete, masonry or other fireresistive material of the wall about the opening and secured thereto, except that the rabbeted frame of a Class B or C door may be of wood, covered with sheet metal not less than No. 26 gauge in thickness, secured to the wall in the opening.

F-402.13.10 Fit: Fire doors when closed shall fit tightly against the wall or frame so as to provide an effective stop for fire and smoke. Except for the metal-covered wooden frame specified in this section, combustible material shall not intervene between the door and the fireresistive material of the wall, floor or roof to which it is fitted.

F-402.13.11 Hardware: Hinge hardware for fire doors shall be of malleable iron or rolled structural steel not less than one quarter ($\frac{1}{4}$) inch thick except that tubular steel track for sliding doors may be not less than one eighth ($\frac{1}{8}$) inch thick. Equivalent thickness of solid bronze or brass may be used. Fire doors shall not depend upon cords, cables or chains to support them in closed position except in elevator shafts.

F-402.13.12 Tracks: Tracks for sliding fire doors shall be so supported that a track hanger comes at each door hanger when the door is closed. Track hangers shall be secured to wood stud walls by through bolts and to concrete walls by through bolts

or approved built-in inserts. Expansion shields shall not be used to support fire doors.

F-402.13.13 Hinges: Hinges for swinging fire doors, except in wooden stud walls, shall be riveted or through-bolted to the structural steel frame of the opening, through-bolted to the wall if of masonry or concrete or secured by approved inserts in the concrete or built into masonry in an approved manner

F-402.13.14 Strap hinges: Strap hinges and sliding door hangers shall be secured to fire doors by through-bolting, riveting or welding. Swinging fire doors in rabbeted frames, except tin-clad, wood core doors, may be hung on butts. Other swinging fire doors shall have strap hinges.

F-402.13.15 Straps, locks and latches: Sliding fire doors shall have adequate stops for the closed position. Swinging Class A fire doors shall have surface latches or unit locks. Class B and C doors shall have surface latches, unit or mortise locks. The latch bolts of unit or mortise locks on fire doors shall have a throw of three quarters (3/4) inch. When mounted in pairs, fire doors shall be rabbeted by means of an astragal or otherwise where they come together. One of a pair of swinging fire doors shall have push bolts at top and bottom with a throw of three (3/4) inch and the other shall be held by latch to the first.

F-402.13.16 Opening hardware: Except in detention buildings, fire doors hung in required exits shall be so fitted with hardware that they can be opened from inside without use of a key when the building is occupied.

F-402.14 Fire door construction

F-402.14.1 Fastening: In the construction of fire doors, solder shall not be used except for filling joints. Sheet metal shall be fastened to wood by nailing and to metal frame by bolting, riveting or welding.

F-402.14.2 Glass: Class A doors shall not have glass panels. Class B doors may have glass panels not larger than one hundred (100) square inches in exposed area nor more than twelve (12) inches in width or height. Class C doors may have glass panels not larger than two thousand and sixteen (2,016) square inches in total exposed area, and any single light shall not have an exposed area exceeding twelve hundred and ninety-six (1,296) square inches. Glass in fire doors shall be wire glass not less than one quarter (1/4) inch thick and shall be set five eighths (5/8) inch in grooves three quarters (3/4) of an inch deep.

F-402.14.3: Deleted

F-402.14.4 Tin-clay, two (2) ply: In-clad, two (2) ply wood core doors shall be constructed in accordance with the specifications of the National Board of Fire Underwriters for such doors in Class B openings and shall bear the label of the Underwriters' Laboratories to this effect.

F-402.14.5 Hollow metals: Hollow metal doors shall have substantial stiles and rails of heavy pressed steel, reinforced for hinges and other hardware. Panels shall be of sheet filled with asbestos board or other approved insulating materials. The door shall be assembled by welding or riveting.

F-402.14.6 Sheet metals: Sheet metal doors shall be constructed with a rolled steel rigid frame covered both sides with one sixteenth (1/16) inch asbestos board and No. 26 gauge corrugated steel metal, with corrugations vertical on one (1) side and horizontal on the other, bound on the edges with rolled steel or pressed steel shapes.

F-402.14.70 Steel rolling: A steel rolling fire door shall be constructed of sheet steel interlocking slats, sliding in grooves, counterweighted by springs, with the roller and mechanism enclosed in heavy sheet metal.

F-402.14.8 Steel plate: A steel plate fire door shall be constructed of not less than No. 12 gauge steel plate mounted on a rolled steel frame, assembled by welding or riveting.

F-402.14.9 Metal clad: A metal clad, paneled fire door shall have a wood core with stiles and rails not less than one and three quarters (1 3/4) inches thick covered with No. 26 gauge sheet steel; panels three quarters (3/4) inch thick covered with No. 26 gauge sheet steel, set three quarters (3/4) inch in grooves; joints of metal lapped and well nailed.

F-402.14.10 Class A label: A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class A opening shall be acceptable as a Class A door.

F-402.14.11 Class B label: A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class B opening shall be acceptable as a Class B door, except that metal clad doors wider than three (3) feet shall not be accepted as Class B doors.

F-402.14.12 Class C label: A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class C opening shall be acceptable as a Class C door.

F-402.15 Fireresistive shutters: Shutters required to be fire shutters or fireresistive shutters shall be constructed and hung as specified for Class B fireresistive doors in Sections F-402.13 and F-402.14.

F-402.16 Fireresistive windows

F-402.16.1 General: Windows which are required to be fire windows, fireresistive windows, or of fireresistive construction shall conform to the requirements of this section.

F-402.16.2 Moveable: Fireresistive windows may be fixed or arranged to open and close. Fixed fireresistive windows shall be so secured in the walls in which they are placed that they may expand in case of fire without buckling. Moveable fireresistive windows shall be opened or closed in one (1) of the following manners:

1. One (1) or more sashes may slide horizontally in a fireresistive frame.
2. One (1) or more sashes may slide vertically with counterweights or with two (2) sashes counterbalanced and hung on chains. If a sash is closed in raised position, it shall have a fastening.
3. A sash may be hinged at top, bottom, or either side.
4. A sash may be pivoted at top and bottom or at the sides.
5. A sash may be arranged to open and close in any other approved manner, with approved hardware.

F-402.16.3 Sash: Moveable sashes in fireresistive windows shall be furred to fireresistive frames of the same or similar construction. Both sashes and frames, and metal mullions between window units, shall be so fitted in the walls in which they are placed as to be continuous with the fireresistive material of the wall and so secured that they may expand in case of fire without buckling.

F-402.16.4 Glass: Glass in fireresistive windows shall be wired glass not less than one quarter ($\frac{1}{4}$) inch thick and the area of a single light shall not exceed seven hundred and twenty (720) square inches. Glass shall be set three eighths ($\frac{3}{8}$) inch grooves at least one half ($\frac{1}{2}$) inch deep. Glass shall be secured by glazing angles or molding screwed to the sash and forming continuous grooves for the glass.

F-402.16.5 Construction: Fireresistive windows shall be of the following construction:

1. Hollow sheet metal sashes and frames fabricated by pressing, welding, riveting or crimping without the use of solder or other fusible alloy, except for filling joints, and bearing the label of Underwriters' Laboratories.
2. Rolled steel or pressed steel sashes fabricated by pressing, welding, riveting or crimping, of a make and style approved by the commissioner.

3. Any other approved constructions as fireresistive as that specified in item 1 above.

F-402.16.6 Hollow sheet metal: Fired fireresistive windows of hollow sheet metal construction shall not exceed seven (7) feet in width not ten (10) feet in height. Fireresistive windows of hollow sheet metal construction with moveable sashes shall not exceed six (6) feet in width nor ten (10) feet in height.

F-402.16.7 Rolled steel: Fireresistive windows of rolled steel construction shall not exceed eighty-four (84) square feet in area not twelve (12) feet in either height or width.

F-402.16.8 Wind pressure: Fireresistive windows and their fastenings shall be capable of resisting the wind pressure on the wall of the building applied either on the inside or the outside of the window exceeding allowable stresses.

F-402.16.9 Substitution: Where fireresistive windows are required, wooden windows and plain glass may be substituted provided the openings are protection by fireresistive doors or shutters, or, in buildings of approved occupancy and construction, by an approved system of open sprinklers.

F-402.17 Fireresistive roof covering

F-402.17.1 Classification: Roof covering allowed under this code shall be classified as fire-retardant or ordinary, according to resistance to fire outside, as provided in this section. Fire-retardant roof covering is the more firereisistive and may be used where fire-retardant roofing is specified. Roof covering less fireresistive than ordinary roof covering shall not be used on any building.

F-402.17.2 Fire-retardant roofing: Fire-retardant roofing shall be any roof covering than meets the requirements of Class A or Class B roofing under the specifications of the Underwriters' Laboratories, Inc. The following roof covering shall be assumed to meet the requirements for fire-retardant roofing:

1. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt; a final layer of asphalt in which, while molten, is embedded a continuous layer of roofing gravel or slag.
2. Built-up roofing consisting of successive layers of roofing felt impregnated with coal tar; a final layer of tar in which, while molten, is embedded a continuous layer of roofing gravel or slag.
3. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt; a final layer of asbestos roofing felt impregnated with asphalt weighing not less than fourteen (14) pounds per hundred (100)

square feet, or a final layer of asphalt-saturated prepared roofing coated with granulated slate or other similar material.

4. Built-up roofing consisting of successive layers of roofing felt impregnated with tar or asphalt and a finish of burned clay floor tile, stone flagging, cement concrete or other similar material.
5. Sheet metal with locked and soldered joints not less than No. 26 gauge in thickness.
6. Shingles of natural slate.
7. Shingles of burned clay tile.
8. Shingles of sheet metal not less than No. 26 gauge in thickness.
9. Shingles of asbestos board not less than one-eighth (1/8) inch thick.
10. Shingles of asphalt saturated felt surfaced with granulated slate or other similar material and carrying the Underwriters Class "C" label.
11. Corrugated sheet metal with lapped joints not less than No. 26 gauge in thickness.
12. Corrugated asbestos board not less than three-sixteenths (3/16) inch thick.

F-402.17.3 Ordinary roofing: Ordinary roofing shall be of any roof covering which meets the requirements of Class C roofing under the specifications of the Underwriters' Laboratories, Inc. The following roof covering shall be assumed to meet the requirements for ordinary roofing:

1. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt, coal tar or other approved material, not equal in fireresistance to a fire-retardant roofing.
2. Prepared roofing consisting of felt or fabric impregnated or coated, or both, with asphalt, tar or other approved material or shingles of such prepared roofing, not equal in fireresistance to fire-retardant roofing.
3. Canvas stretched tightly and coated with paint.

F-402.17.4 Means of securing: Built up roofing shall be secured to the roof deck in the following manner:

1. Over masonry slab, the first layer shall be laid in molted asphalt or tar mopped on the roof deck, after the deck is properly primed, or by nailing a layer of building paper to nailing inserts other than wood placed in the deck.
2. Over wood decks, the built-up roofing shall be secured by nailing a layer of building paper to the roof deck over which the prepared roofing is to be laid with the first layer laid in molten asphalt or tar.
3. Roofings other than built-up roofings, such as shingles, slates, and tile roll roofing shall be well secured to the deck by nailing, bolting, wiring, or other approved methods.

APPENDIX G

SPECIALIZED MASSACHUSETTS RULES AND REGULATIONS OTHER THAN STATE BOARD OF BUILDING REGULATIONS AND STANDARDS

Specific numbers have been established by the Massachusetts Office of the Secretary of State to identify for reference purposes all rules and regulations promulgated by agencies of the Commonwealth of Massachusetts. These numbers are designated as "Code of Massachusetts Regulations" (CMR's).

EXECUTIVE OFFICE OF CONSUMER AFFAIRS, DIVISION OF REGISTRATION

Board of State Examiners of Plumbers and Gas Fitters

Massachusetts State Plumbing Code	248 CMR 2.00
Massachusetts Fuel Gas Code	248 CMR 3.00 - 8.00

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS OUTDOOR ADVERTISING DIVISION

Outdoor Advertising Board

Control and Restriction of Billboards, Signs, and other Advertising Devices, August 1, 1978	
Rules and Regulations for	311 CMR 3.00

THE MASSACHUSETTS STATE BUILDING CODE

EXECUTIVE OFFICE OF HUMAN SERVICES, DEPARTMENT OF PUBLIC HEALTH, DIVISION OF ENVIRONMENTAL HEALTH

Division of Health Care Standards

Designer's Guide (Bureau of Planning and Construction)

Dispensaries and Clinics, December 21, 1966-

Rules and Regulations for the licensure of 105 CMR 140.00

Hospitals in Massachusetts, 1971 - Licensure

Rules and Regulations for 105 CMR 130.000

Intensive Care Unit Amendment, October 1, 1972 105 CMR 130.520
through 103.535

Long Term Care Facilities in Massachusetts,
September 29, 1972, General Standards of

Construction-Rules and Regulations for 105 CMR 151.000

The State Sanitary Code

Camp Grounds, Developed Family Type-

Minimum Standards for 310 CMR 18.00 Article VIII*

Farm Labor Camps - Housing and Sanitation

Standards for 105 CMR 420.000 Article III

Food Service Establishments-

Minimum Sanitation Standards for 105 CMR 595.000 Article X

General Application and Administration 105 CMR 400.00 Article I

Human Habitation , Fitness-

Minimum Standards of 105 CMR 410.000 Article II

Recreational Camps for Children-

Sanitation Standards for 105 CMR 430.000 Article IV

Swimming Pools-Minimum Standards for 310 CMR 16.00 Article VI*

*Articles VI and VIII of the State Sanitary Code have been transferred to the
Department of Environmental Quality and Engineering.

SPECIALIZED MASSACHUSETTS RULES AND REGULATIONS

EXECUTIVE OFFICE OF MANPOWER AFFAIRS, DEPARTMENT OF LABOR AND INDUSTRIES

Division of Industrial Safety

Accidents on Construction Operations- Rules and Regulations for	441 CMR 10.00 Industrial Bulletin No. 12
Accidents in Window Cleaning-Rules and Regulations for the Prevention of	441 CMR 19.00 Industrial Bulletin No. 21
Care of Employees, Injured or Taken Ill in Industrial Establishments	441 CMR 12.00 Industrial Bulletin No. 14
Lighting Code for Factories, Workshops, Manufacturing, Mercantile Establishments	441 CMR 16.00 Industrial Bulletin No. 18
Structural Painting-Revised Rules and Regulations and Recommendations Pertaining to	441 CMR 11.00 Industrial Bulletin No. 13
Toilets in Industrial Establishments	441 CMR 2.00 Industrial Bulletin No. 4

EXECUTIVE OFFICE OF PUBLIC SAFETY, DEPARTMENT OF PUBLIC SAFETY

Architectural Barriers Board

Architectural Barriers Board- Rules and Regulations of the	521 CMR 3.00 (161AB)
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Board of Boiler Rules

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Low Pressure Steam-Heating Boilers	522 CMR 5.00 (BLR-3)
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Part IV-Steam Boiler Rules	522 CMR 6.00 (BLR-4)
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Part I-Air Tank Regulations, Installation and Inspection	522 CMR 7.00 (BLR-5)
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Part II-Air Tank Regulations, Installation and Inspection	522 CMR 8.00 (BLR-6)
Refrigeration and Air Conditioning	522 CMR 9.00 (BLR-7)
Material Specifications	522 CMR 10.00 (BLR-8)
Welding Specifications	522 CMR 11.00 (BLR-9)
Fiberglass-Reinforced Plastic Pressure Vessels	522 CMR 12.00 (BLR-11)
Board of Elevator Regulations	
Elevator and Escalator Regulations	524 CMR 2.00 (ELV-1) through 11.0
Elevator, Dumbwaiter, Escalator, and Moving Walk Regulations	524 CMR 15.00 (ELV-2) through 34.0
Board of Fire Prevention Regulations	
Dry-Cleaning and Dry-Dyeing and the Keeping, Storage and Use of Cleaning and Dyeing Fluid in Connection Therewith- Rules and Regulations Governing	527 CMR 3.00 (FPR-2)
Fires, the Prevention of Fire and Fire Hazards, Remedying any Condition Found to Exist in or about any Building or other Premises or on any Ship or Vessel in Respect to-Rules and Regulations for the Purpose of	527 CMR 10.00 (FPR-9)
Flammable Decorations in Public Buildings, Places of Assembly, Hotels, Family Hotels, Stores, Public or Private Institutions, Public or Private School Buildings, Churches, Theaters, Special Halls, Public Halls or Miscellaneous Halls-Rules and Regulations Prohibiting or Regulating	527 CMR 21.00 (FPR-20)
Flammable Fluids, Solids or Gases, Keeping, Storage, Manufacture or Sale in Limited Quantities of- Rules and Regulations Governing	527 CMR 14.00 (FPR-13)

Garages, and the Related Storage, Keeping
and Use of Gasoline, the Construction
and Maintenance of Buildngs or Other
Structures used as-
Rules and Regulations Governing 527 CMR 5.00 (FPR-4)

Liquefied Petroleum Gas Systems, Gas
Piping and Appliance Installation in
Buildng, the Construction, Location,
Installation and Operation-
Rules and Regulations Governing 527 CMR 6.00 (FPR-5)

Massachusetts State Electrical Code 527 CMR 12.00 (FPR-11)

Oil Burning Equipment and the Keeping,
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Rules and Regulations Governing the Construction,
Installation, and Operation of 527 CMR 4.00 (FPR-3)

Plastics, Manufacturing and Handling of-
Rules and Regulations Governing 527 CMR 7.00 (FPR-6)

Tanks and Containers, Construction,
Location, Use and Maintenance of-
Rules and Regulations Governing 527 CMR 9.00 (FPR-8)

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APPENDIX H

HISTORIC STRUCTURES

Historic structure individually listed in the National Register of Historic Places, qualifying as totally preserved buildings (see Section 635.3).

Acton	Faulkner Homestead, High Street
Agawam	Capt. Charles Leonard House, Main Street
Amesbury	Rocky Hill Meetinghouse, Portsmouth Road
Arlington	Fowle-Reed-Wyman House, 64 Old Mystic Street Jason Russell, 7 Jason Street Old Schwamb Mill, 17 Mill Lane
Barre	Barre Historical Society, Common Street
Barnstable	Barnstable Custom House, Route 6A
Bedford	Job Lane House, 295 North Road
Beverly	John Balch House, 448 Cabot Street Capt. John Cabot House, 117 Cabot Street Rev. John Hale House, 39 Hale Street
Boston	Gleason House, Beacon Street James Blake House, E. Cottage Street (Dor.) Clapp Houses, 105 Boston Street (Dor.) Loring-Greenough House, 12 South Street (JP) Old State House, 15 State Street Pierce House, 24 Oakten Avenue (Dor.) South End Historical Soc., 532 Mass. Avenue Isabella Stewart Gardner Museum, 280 The Fenway
Boxford	Holyoke-French House, Elm Street Sylvanius-Thayer Birthplace, 786 Washington St

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Brookline	Edward Devotion House, 347 Harvard Street
Burlington	Francis Wyman House, Francis Wyman Road
Cambridge	Cooper-Frost-Austin House, 21 Linnaean St.
Charlton	Ryder Tavern, Stafford Street
Chelmsford	Old Chelmsford Garrison House, 105 Garrison Road
Chelsea	Gov. Bellingham-Cary House, 34 Parker Street
Cohasset	Caleb Lothrop House, 14 Summer Street
Danvers	Fowler House, 166 High Street Rebecca Nurse House Glen Magna House
Dennis	Josiah Dennis Manse, Nobscuset Road West Schoolhouse
Duxbury	Gershom Bradford House, 931 Tremont Street King Caesar House, King Caesar Road
Gloucester	Beauport, Eastern Pt. Blvd. Hammond Castle, 80 Hesperus Avenue
Hadley	Hadley Farm Museum, Russell Street Porter Phelps Huntinghouse, 130 River Drive
Haverhill	The Whittier House, 305 Whittier Road
Holyoke	Wisteriahurst, 238 Cabot Street
Ipswich	Castle Hill, Argilla Road
Lee	Merrell Tavern, Route 102
Lexington	Buckman Tavern, 1 Bedford Street Sanderson House, 314 Massachusetts Ave. Monroe Tavern, 1332 Massachusetts Ave.
Lincoln	The Grange, Codman Road

HISTORIC STRUCTURES

Lowell	Whistler House, Worthen Street
<u>Ludlow</u>	<u>First Meeting House of Ludlow Center</u>
Lynnfield	Meetinghouse
Medford	Peak House, 347 Main Street
Milton	Dr. Amos Holbrook House, 203 Adams Street Daniel Vose House, 1370 Canton Avenue
Nantucket	Whaling Museum, Broad Street Fire Hose Cart House, 8 Gardner Street Greater Light, 8 Howard Court Old Gaol, 15 Vestal Street 1800 House, 4 Mill Street Old Mill, 50 Prospect Street Hawden House, 96 Main Street Nathaniel Macy House, 12 Liberty Street Thomas Macy Warehouse, 10 Straight Wharf Fair Street Museum, 7 Fair Street Quaker Meeting House, 7 Fair Street
New Bedford	Benjamin Rodman House, 50 North Second Street
New Salem	Whitaker-Clary House, Elm Street
Newbury	Tristram Coffin House, 16 High Road Spencer-Pierce-Little House, Little Lane
Newton	Jackson Homestead, 527 Washington Street
No. Andover	Parson Barnard House, Osgood Street
No. Easton	Old Colony Railroad Station, Oliver Street
Norwood	Fred Holland Day, 93 Bay Street
Orleans	French Cable Station, Cove Road
Oxford	Clara Barton Homestead, Clara Barton Road
Peabody	Gen. Gideon Foster House, 35 Washington Street
Pittsfield	Herman melville House, 78 Holmes Road

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Plymouth	Plymouth Antiquarian Society, 126 Water Street Harlow Old Ft. House, 19 Sandwich Street Pilgrim Hall, 75 Court Street Richard Sparrow House, 42 Summer Street
Quincy	Adams Academy, 8 Adams Quincy Homestead, 34 Butler Street Josiah Quincy House, 20 Muirhead Street
Randolph	Johnathan Belcher House, 360 N. Main
Reading	Parker Tavern, 103 Washington Street
Rockport	Old Castle, Castle Lane
Salem	House of 7 Gables, 46-54 Turner Street Essex Institute, Essex Street The Norbone House Witch Museum Crowningshield Bently, Essex Street Gardner-Pingree House, 128 Essex Street Gedney House, 21 High Street Cox House, 19 High Street
Sandwich	Hoxie House, 18 Water Street Eldred House, 4 Water Street Wing Fort House, Spring Hill Road
Sheffield	Col. John Ashley House, Cooper Hill Road
Shrewsbury	Gen. Artemas Ward Homestead, Main Street
Springfield	Alexander House, State Street George Walter Vincent Smith Art Museum
Stockbridge	Naumkeag, Prospect Hill
Swansea	The Luther Store, 160 Old Warren Road The Martin House, 22 Stoney Hill Road
Taunton	Old Colony Historical Society, 66 Church Green Parson Capen House
Watertown	Edmund Fowle House, 26 Marshall Street

HISTORIC STRUCTURES

Wenham	Claflin-Richard House, 132 Main
West Springfield	Josiah Day House, 70 Park Street
Weston	Gold Ball Tavern, Old Post Road
Woburn	Loammi Baldwin Mansion, 2 Alfred Street
Wilmington	Harden Tavern, 436 Salem Street
Worcester	Timothy Paine House, 140 Lincoln Street

National Historic Landmarks

Amesbury	John Greenleaf Whittier Home, 86 Friend Street
Boston	African Meeting House, 8 Smith Court Nichols House, 55 Mt. Vernon Street Brook Farm, 678 Baker Street (Rox.) Christ Church, 191 Salem Street Faneuil Hall, Dock Square 1st Harrison Gray Otis House, 141 Beacon Street Paul Revere House, 19 North Street
Concord	Ralph Waldo Emerson House, 28 Cambridge Tpk. The Old Manse Orchard House, 299 Lexington Road
Dedham	Fairbanks House
Deerfield	Old Deerfield Village Historic District
Hancock	Hancock Shaker Village
Harvard	Fruitlands, Prospect Street
Hingham	Old Ship Meetinghouse, Main Street
Ipswich	John Whipple House, 53 S. Main Street
Lexington	Hancock Clarke House, 35 Hancock Street
Marblehead	Jeremiah Lee House, Washington Street King Hooper Mansion, Hooper Street

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Marshfield	Daniel Webster Law Office, Webster Street
Medford	Peter Tufts House, 350 Riverside Drive Isaac Royal House, 15 George Street
Milton	Capt. R. B. Forbes House, 215 Adams
Nantucket	Nantucket Historic District Jethro Coffin House, Sunset Hill
New Bedford	New Bedford Historic District
Newburyport	Caleb Cushing House, 98 High Street
Quincy	John Adams Birthplace, 133 Franklin Street John Quincy Adams Birthplace, 141 Franklin Street
Salem	Peabody Museum The Custom House, 178 Derby Street
Saugus	Scotch Boardman House, 117 Howard Street
Stockbridge	Chesterwood, Williamsville Road The Mission House, Main Street
Waltham	The Vale, Lyman Street Gore Place, 52 Gore Street
Woburn	Count Rumford Birthplace, 90 Elm Street
Worcester	American Antiquarian Society, 185 Salisbury Street

HISTORIC STRUCTURES

Historic structures individually listed in the National Register of Historic Places not qualifying as totally preserved buildings (see Partially preserved buildings, Section 635.0). Refer to:

1. National Register of Historic Places, U.S. Federal Register, February 1, 1978, Part II.
2. National Register of Historic Place (additions). Contact the Massachusetts Historical Commission at 80 Boylston Street, Suite 310, Boston, 02611.

Historic districts listed in the National Register of Historic Places. Refer to:

1. National Register of Historic Places, U.S. Federal Register, February 1, 1979, Part II.
2. National Register of Historic Place (additions). Contact the Massachusetts Historical Commission at 80 Boylston Street, Suite 310, Boston, 02611.

Structures proposed for certification as partially preserved not listed in the national register of historic places. Refer to Massachusetts Historical Commission Inventory Forms.

Contact the Massachusetts Historical Commission at 80 Boylston Street, Suite 310, Boston, 02611.

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APPENDIX I

INDEPENDENT STRUCTURAL ENGINEER REVIEW

(Appendix I, in total, is a new Appendix effective 6/19/92)

I-1 Primary structure: For the purposes of the independent structural engineering review, the primary structure shall be defined as the structural frame, the load supporting parts of floors, roofs, and walls, and the foundations. Cladding, cladding framing, stairs, equipment supports, ceiling supports, non-load bearing partitions, and railings are excluded from this definition of primary structure.

I-2 Reviewing engineer: The reviewing engineer shall be engaged by the owner.

I-2.1 Qualifications: The reviewing engineer shall be a professional structural engineer, registered in Massachusetts, qualified by experience and training and who shall have had structural design experience with buildings or structures similar to that covered by the application for the building permit. The reviewing engineer shall be impartial, and shall be independent of the architect of record, structural engineer of record, and contractors and suppliers who will be involved in the construction of the structure.

I-3 Criteria for review: The reviewing engineer shall review the plans and specifications submitted with the application for the building permit for compliance with the structural and foundation design provisions of the Code. He shall perform the following tasks:

1. Check to assure that the design loads conform with the Code;
2. Check that other design criteria, and design assumptions, conform to the Code and are in accordance with accepted engineering practice;
3. Review geotechnical and other engineering investigations that are related to the structural design to determine if the design properly incorporates the results and recommendations of the investigations;
4. Check that the organization of the structure is conceptually correct : and

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5. Make independent calculations for a representative fraction of systems, members, and details to check their adequacy. The number of representative systems, members, and details shall be sufficient to form a basis for the reviewer's conclusions.

I-3.1 Structural Calculations: The structural calculations prepared by the structural engineer of record shall be submitted to the reviewing engineer, upon his request, for his reference only. The reviewing engineer shall not be obligated to review or check these calculations. If the design criteria and design assumptions are not shown on the drawings or in the computations, the structural engineer of record shall provide a statement of these criteria and assumptions for the review.

I-4 Structural engineer of record: The structural engineer of record shall retain sole responsibility for the structural design, and the activities and reports of the reviewing engineer shall not relieve the structural engineer of record of this responsibility.

I-5 Report and follow-up:

1. The reviewing engineer shall prepare a report to the building official stating whether or not the structural design shown on the drawings and the specifications conform with the structural and foundation requirements of this Code. Said report shall be based on the review as prescribed in Appendix I and shall include a summary of all deficiencies, if any, which cannot be resolved with the structural engineer of record.
2. The structural engineer of record shall review the report of the reviewing engineer, and notify the building official in writing, whether or not he agrees with or disputes the conclusions and recommendations of the reviewing engineer.
3. Unresolved disputes between the structural engineer of record and the reviewing engineer shall be submitted by the building official, the owner, the structural engineer of record or the reviewing engineer to the Structural Peer Review Advisory Board for resolution.
4. Any changes to the structural design subsequent to the original submission of the plans and specifications shall be shown on revised drawings and specifications, submitted with an amendment to the application for permit. The reviewing engineer shall review the changes on the revised drawings and specifications, and, if the original report does not account for the changes in said drawings and specifications, a supplementary report relating to the changes and prepared by the reviewing engineer shall be made to the building official.

INDEPENDENT STRUCTURAL ENGINEER REVIEW

I-6 Foundation permits: When the plans and specifications are partially complete and an application is made for a foundation permit, the reviewing engineer may review the foundation plans and specifications on a conditional basis, provided that the reviewing engineer is given sufficient documentation so that he can perform Tasks 1, 2, 3, and 4 in Section I-3 for the whole structure, and so that he can perform Task 5 in Section I-3 for that part of the foundation covered by the application for foundation permit. The reviewing engineer shall prepare a report on that part of the foundation covered by the application for foundation permit, as prescribed in Section I.5, stating all conditions upon which the report is based. When the reviewing engineer reviews the completed plans and specifications as prescribed in Section I.3, he shall reperform Tasks 1, 2, 3, and 4, as necessary, to include all the revisions to the design subsequent to the application for the foundation permit.

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COMMONWEALTH OF MASSACHUSETTS

BOARD OF BUILDING REGULATIONS AND STANDARDS

RULES AND REGULATIONS

780 CMR-1 through -5

Published by

**Michael J. Connolly
Massachusetts Secretary of State**

780-CMR -1 through -5

FOREWORD

Contained herein are the RULES and REGULATIONS of the Massachusetts Board of Building Regulations and Standards, hereinafter known as the BBRS. In accordance with MGL C143, the BBRS is authorized to adopt rules and regulations which govern how authorized programs are administered.

These Rules and Regulations were formerly called Appendix Q in Edition 4 of the Massachusetts State Building Code. For Edition 5, they were made a separate document to reduce the size of the basic code, as well as to make them more readily available to interested parties.

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CONCRETE TESTING LABORATORIES LICENSING RULES AND REGULATIONS

FOREWORD

Contained herein are the RULES and REGULATIONS for the Licensing of Concrete Testing Laboratories of the Massachusetts Board of Building Regulations and Standards, hereinafter known as the BBRS. In accordance with MGL C143, the BBRS is authorized to adopt rules and regulations which govern how authorized programs are administered.

These Rules and Regulations were formerly in Appendix Q in Edition 4 of the Massachusetts State Building Code. For Edition 5, they were made a separate document to reduce the size of the basic code, as well as to make them more readily available to interested parties.

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CONCRETE TESTING LABORATORIES
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**780-CMR-1
CONCRETE TESTING LABORATORIES
LICENSING RULES AND REGULATIONS**

**SECTION 1
ADMINISTRATION**

1.1 TITLE

As authorized by MGL C143, and in accordance with Section 128 of the State Building Code, establishing the Construction Materials Safety Board, the following Rules and Regulations are adopted for Licensing of Concrete Testing Laboratories.

1.2 DEFINITIONS

Unless otherwise expressly stated in the State Building Code, the following terms shall, for the purpose of these Rules and Regulations, have the meaning indicated in this Section:

Accredited Laboratory: A laboratory which has been licensed in accordance with these regulations by the BBRS.

BBRS: State Board of Building Regulations and Standards

Board: Construction Materials Safety Board (CMSB).

Branch Laboratories: A branch of a Testing Laboratory physically removed from the location of the headquarters or main testing facility of the Testing Laboratory.

Code: Commonwealth of Massachusetts State Building Code (SBC).

Laboratories: Testing laboratory, branch laboratory, and project laboratory.

Person: Individual, partnership, corporation, trust, joint venture, etc.

Pre-Qualifying Agency: Construction Materials Safety Board (CMSB).

Project Laboratory: A temporary on-site facility providing concrete testing services for a specific project under the direction of a testing or branch laboratory licensed by the Commonwealth of Massachusetts.

Testing Agency: National Institute of Standards and Technology Cement and Concrete Reference Laboratory (CCRL), the Army Corps of Engineers, or other agency designated by the BBRS.

Testing Laboratory: A proprietorship, corporation, partnership or agency which conforms to the requirements of ASTM E 329-72 as modified in these regulations.

1.3 LICENSING

All laboratories defined by these Regulations as Testing Laboratories, Branch Laboratories and Project Laboratories which are engaged in the testing of concrete and concrete materials for use in buildings and structures subject to control according to the provisions of Section 127.0 of the Massachusetts State Building Code will be licensed by the BBRS in accordance with these regulations.

1.4 APPLICATION FOR LICENSING

Each laboratory desiring to obtain such license shall make application to the BBRS upon such form and in such manner as the BBRS shall prescribe and shall furnish evidence satisfactory to the BBRS that the laboratory equipment meets the requirements of Section 2 and its management personnel are qualified in accordance with Sections 4 and 5 of these Rules and Regulations. Such application shall also include payment of the licensing fee set forth in Section 1.8 of these Rules and Regulations.

1.5 PRE-QUALIFYING AGENCY

The BBRS hereby designates the Construction Materials Safety Board as its Pre-Qualifying Agency, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its Pre-Qualifying Agency. The Pre-Qualifying Agency shall examine, or cause to be examined, the evaluation performed by the Testing Agency and the personnel on each Concrete Testing Laboratory application and make its recommendation to the BBRS regarding such license.

1.6 TESTING AGENCY

The BBRS hereby designates the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology and the Army Corps of Engineers as the agencies to examine and evaluate all laboratories desiring to be licensed in the practice of concrete testing, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its Testing Agency.

1.7 NOTIFICATION OF TESTING AND TESTING RESULTS

The Testing Agency shall notify the applicant of the date for evaluation. The BBRS shall be informed by the Testing Agency/Pre-Qualifying Agency of the evaluation results and recommendations.

1.8 LICENSING FEE

The fee for licensing shall be one hundred and fifty (\$150.00) dollars per annum or in accordance with the authorized fee schedule.

1.9 NUMBER AND CLASSIFICATION

Each laboratory so licensed by the BBRS shall be issued a number and classification.

1.10 RENEWALS

Commencing January 1, 1978, all licenses issued shall expire on December 31 of the year issued. Within thirty (30) days before the expiration date of any such license, the Administrator of the BBRS shall forward to each laboratory so licensed an application form for renewal. Said renewals shall be returned to the BBRS by December 31. The said Administrator, upon receipt of the completed form and fee, shall renew the license for a period of one (1) year or notify such applicant of the BBRS's refusal with reasons thereof.

1.11 PENALTIES

Any such person and/or laboratory who fails to comply with the requirements of these Rules and Regulations or who files a false report shall be subject to the penalties and actions as prescribed in Section 121 of the Code.

SECTION 2 LABORATORY LICENSING REQUIREMENTS

2.1 ASTM TESTING REQUIREMENTS

Except as modified in these regulations, all testing laboratories including branch laboratories shall conform to Sections 5 and 6 of the ASTM E 329-72 standard requirements for testing of concrete and its constituent materials.

EXCEPTION: The following sections of ASTM E 329-72 shall not apply:

Sections 2.2; 2.3; 2.7; 3.2.7; 3.3; 3.4 C360 of 6.2; 7; 8; 9 and 10.

2.2 ASTM EQUIPMENT AND PERSONNEL REQUIREMENTS

All laboratories subject to these regulations shall be approved and licensed in accordance with the ASTM E 329-72 standard for the performance of those functions recommended in standard ASTM E 329-72, for equipment and personnel, as modified in these Regulations.

SECTION 3 PRE-QUALIFICATION REQUIREMENTS FOR LABORATORIES

3.1 EVALUATION

- a) Testing and branch laboratories subject to these regulations shall be examined and evaluated, upon notification from the BBRS, by a Testing Agency designated by the BBRS. The interval between such examination and evaluation shall not exceed three (3) years.
- b) Project laboratory equipment which is used in the testing of concrete materials for use in buildings and structures subject to the provisions of the Massachusetts BBRS shall conform to the requirements of ASTM E 329 as modified by Section 2 of these Rules and Regulations.
- c) Reports of evaluations by the testing agency shall be filed with the BBRS within ten (10) days of receipt of the report by the laboratory, unless a waiver is granted by the laboratory to have the report sent directly to the BBRS by the Testing Agency.
- d) Laboratory deficiencies cited in the report of the Testing Agency shall be corrected within thirty (30) days of the date of issue of the report and shall be so certified by an affidavit submitted by the laboratory on a form supplied by the BBRS.

3.2 REVIEW OF DEFICIENCIES

Laboratories which fail to meet the requirements of items (c) and (d) shall be subject to review and revocation of their license by the BBRS.

3.3 TESTING MACHINES

Compression testing machines used for testing materials subject to these Regulations shall be calibrated and verified, with equipment traceable to the National Institute of Standards and Technology, at least annually or as required by the BBRS, and the results submitted to the BBRS.

SECTION 4 PERSONNEL

The management and supervision of each laboratory subject to these Regulations shall be in accordance with the following requirements:

4.1 REQUIRED

Each accredited licensed Concrete Testing Laboratory must have an individual approved by the BBRS in each of three (3) distinctly different categories: Director of Testing Services, Supervisory Laboratory Technician and Supervisory Field Technician. An individual may fill more than one position at the particular laboratory if he meets all the qualifications for each position, but he may not fill positions concurrently at a separate (branch or project) laboratory. The project laboratory must have a full-time resident supervisory laboratory technician qualified in accordance with these Regulations.

4.2 FILING OF QUALIFICATIONS

Each individual being certified for a position must submit their credentials and qualifications under penalty of perjury with their signature notarized. Individuals applying for certification in more than one (1) category must file separate applications for each position as described in Section 5. Application for certification shall be filed within thirty (30) days of employment for such duties. It is the responsibility of the Director of Testing Services to notify the BBRS within seven (7) days of any vacancy of any position. Any vacant position shall be filled within thirty (30) days.

SECTION 5 QUALIFICATIONS

5.1 QUALIFICATIONS FOR DIRECTOR OF TESTING SERVICES

The testing services of each laboratory (main, branch or project) shall be under the direction of a Director of Testing Services who shall be a full-time resident employee of that laboratory and shall be qualified in accordance with any one (1) of the following three (3) sets of requirements:

- a) He shall be a Professional Engineer, registered in the Commonwealth of Massachusetts with a least five (5) years of experience in responsible charge of work related to Structural Engineering, Construction Engineering or Construction Materials Testing. He shall be subject to

demonstrate his ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72; or,

- b) He shall have a Bachelor's Degree in Engineering from an accredited institution and an additional total of three (3) years' experience performing tests on concrete and concrete materials which shall include two (2) years as a laboratory technician or supervisor. He shall be subject to demonstrate his ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72; or
- c) He shall have at least eight (8) years' experience including five (5) years' experience as a laboratory technician or supervisor and shall be subject to demonstrate his ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72.

5.2 QUALIFICATIONS FOR SUPERVISORY LABORATORY TECHNICIAN

A Supervisory Laboratory Technician shall have at least five (5) years' experience performing tests on construction materials including concrete and concrete aggregates. He shall be subject to demonstrate his ability to perform correctly tests of concrete and aggregates as stated in ASTM E 329-72. "Class A" accreditation by the Pre-Qualifying Agency shall be required as qualification for concrete only. (See Rules and Regulations for Concrete Testing Personnel.)

5.3 QUALIFICATIONS FOR SUPERVISORY FIELD TECHNICIAN

A Supervisory Field Technician shall have at least five (5) years' experience performing tests on construction materials including concrete. He shall be subject to demonstrate either by oral or written examination, or both, his ability to perform correctly the tests of concrete as stated in ASTM E 329-72. "Class A" accreditation by the Pre-Qualifying Agency shall be required as qualification for concrete only. (See Rules and Regulations for Concrete Testing Personnel.)

SECTION 6 PROJECT AFFIDAVIT

In accordance with Section 113.5.1 of this code, those structures subject to control as required in Section 127.0 of said code, affidavits must be submitted with the building permit application that the individuals and testing laboratories responsible for carrying out the duties of Section 127.0 have been licensed and registered by the BBRS.

6.1 AFFIDAVIT

Form Number BBRS-L-303-76, as furnished by the licensed laboratory (sample submitted to each laboratory) shall be used by the licensed laboratory for each building project.

6.2 NOTICE OF TERMINATION

The building official shall receive written notification of the termination of laboratory functions certifying that the owner has also been so notified. Such termination shall be effective no earlier than three (3) working days from the notification received by the building official.

6.3 SUCCESSOR LABORATORY

If concrete testing is to be continued for the said project by a successor laboratory, such notice shall be given to the building official and a new project affidavit shall be filed with the building official.

SECTION 7 REVOCATION AND SUSPENSION PROCEDURES

7.1 REVOCATION AND SUSPENSION

The BBRS on its own initiative or upon the recommendation of the Construction Materials Safety Board may suspend or revoke the license of any Testing Laboratory or Project Laboratory found to be in noncompliance with these Rules and Regulations, the State Building Code, or the standards of good practice. Notice of suspension or revocation of such license shall be in writing with the reasons for suspension or revocation clearly set forth therein, and served in accordance with Section 121.2.1 of the Massachusetts State Building Code.

7.2 NOTICE AND CONFERENCE

Prior to suspension, revocation, or refusal to renew the license of an accredited laboratory, written notice of such intent shall be served by the Construction Materials Safety Board of the BBRS in accordance with Section 121.2.1 of this Code. Within ten (10) calendar days of receipt of such notice, the affected accredited laboratory may request a conference before a three (3) member panel designated by the Chairman of the Construction Materials Safety Board, who will hear facts and make their recommendations to the Construction Materials Safety Board, for consideration/action by the BBRS.

7.3 EFFECT OF

Upon suspension or revocation of the license, the accredited laboratory shall immediately cease engaging in the testing of concrete and concrete materials for use in buildings and structures which are subject to the provision of the Massachusetts State Building Code and no action brought before the Board of Appeals as specified in Section 8.1 of these regulations or in any court of competent jurisdiction shall stay the said suspension or revocation unless said Board of Appeals or court shall issue an order for a stay of the BBRS's suspension or revocation.

**SECTION 8
APPEALS****8.1 BUILDING CODE APPEALS BOARD**

Any laboratory or individual aggrieved by the suspension or revocation of their license or by an interpretation, order, requirement, direction or failure to act under these Rules and Regulations may appeal to the State Building Code Appeals Board as provided in Section 126 of this Code; however, entry of an appeal from the BBRS's order of revocation or suspension shall not stay such revocation or suspension unless so ordered by the State Building Code Appeals Board in a preliminary hearing conducted expressly for the purpose of a stay in accordance with that part of Section 126.3.2 of this Code dealing with procedures required for a hearing on such stay.

780-CMR-2

CONCRETE TESTING PERSONNEL LICENSING RULES AND REGULATIONS

FOREWORD

Contained herein are the RULES and REGULATIONS for the Licensing of Concrete Testing Personnel of the Massachusetts Board of Building Regulations and Standards, hereinafter known as the BBRS. In accordance with MGL C143, the BBRS is authorized to adopt rules and regulations which govern how authorized programs are administered.

These Rules and Regulations were formerly in Appendix Q in Fourth Edition of the Massachusetts State Building Code. For the Fifth Edition, they were made a separate document to reduce the size of the basic code, as well as to make them more readily available to interested parties.

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CONCRETE TESTING PERSONNEL RULES AND REGULATIONS

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**780-CMR-2
CONCRETE TESTING PERSONNEL
LICENSING RULES AND REGULATIONS**

**SECTION 1
ADMINISTRATION**

1.1 TITLE

As authorized by MGL C143, and in accordance with Section 128 of the State Building Code establishing the Construction Materials Safety Board, the following Rules and Regulations are adopted for Concrete Testing Personnel.

1.2 DEFINITIONS

Unless otherwise expressly stated in the State Building Code, the following terms shall, for the purpose of these Rules and Regulations, have the meaning indicated in this Section.

BBRS: State Board of Building Regulations and Standards

Board: Construction Materials Safety Board (CMSB)

Code: Commonwealth of Massachusetts State Building Code (SBC)

Concrete Testing Personnel: A person issued a Class "A," "B," or "C" license by the BBRS authorizing such person to test/inspect concrete.

Field Concrete Technician: A person issued a Class "A" license by the BBRS to test concrete in the field.

Pre-Qualifying Agency: Construction Materials Safety Board (CMSB)

Testing Agency: Massachusetts Construction Industry Board (MCIB)

1.3 LICENSING

All Concrete Personnel engaged in the testing/inspection of concrete for use in buildings and structures subject to control according to the provisions of Section 127 of this code shall be licensed by the BBRS in accordance with these regulations.

1.4 APPLICATION FOR LICENSING

Each person desiring to obtain such license shall make application to the BBRS upon such form and in such manner as the BBRS shall prescribe and shall furnish evidence satisfactory to the BBRS that he is qualified to be licensed in accordance with these Rules and Regulations.

1.5 PRE-QUALIFYING AGENCY

The BBRS hereby designates the Construction Materials Safety Board as its Pre-Qualifying Agency, provided however, that the BBRS may revoke such designation at any time and may designate any other agency or agencies which it deems qualified, from time to time, to act as its Pre-Qualifying Agency. The Pre-Qualification Agency shall examine, or cause to be examined, the examination results and evaluation performed by the Testing Agency on each Concrete Testing Personnel Application and make its recommendation to the BBRS regarding such license.

1.6 TESTING AGENCY

The BBRS hereby designates the Massachusetts Construction Industry Board (MCIB) as the agency to examine and evaluate all persons desiring to be licensed in the practice of concrete testing, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its Testing Agency. The Testing Agency shall submit all examination results and evaluation on each Concrete Testing Application and make its recommendations to the Pre-Qualification Agency regarding such license.

1.7 EXAMINATION

Accompanied by the application, there shall be paid to the Testing Agency an initial examination fee to cover the cost of such testing. The Testing Agency may also assess fees for partial or complete retesting. The Testing Agency is authorized to require the applicant to provide all required test equipment.

1.8 NOTIFICATION OF EXAMINATION AND EXAMINATION RESULTS

The Testing Agency shall notify the applicant of the time and place for the examination. The BBRS shall be informed by the Testing Agency/Pre-Qualifying Agency of the examination results, evaluation and recommendations. Within fourteen (14) days therefrom, the BBRS shall notify the applicant of its decision. If the applicant fails fully or partially, he may request of the Testing Agency a retesting. If the applicant is notified by the BBRS that he has met all the requirements herein established, he shall submit to the said BBRS, the license fee

in accordance with section 1.9 of these Rules and Regulations, and his 1¼" x 1¼", full face, black and white or color photograph.

1.9 LICENSING FEE

The fee for licensing is fifty (\$50) dollars in accordance with the authorized fee schedule. Concrete Testing Personnel employed for that purpose by a municipality or county, or the federal government, or the Commonwealth or any department, commission, agency or authority of, or created by, the Commonwealth, shall be exempt from this fee.

1.10 NUMBER AND CLASSIFICATION

Each person so licensed by the BBRS shall be issued a number and classification.

1.11 RENEWALS

Licenses shall be valid for two (2) years. Within thirty (30) days before the expiration date of any such license, the Administrator of the BBRS shall forward to each person so licensed an application form for renewal. The said Administrator, upon receipt of the completed form and fee, shall renew the license for a period of two (2) years or notify such applicant of the BBRS's refusal with the reasons thereof. Upon successful completion of a Class A Technician's examination said applicant is eligible to be licensed upon submittal of an application and fee at any time without further testing, provided when unlicensed said applicant is not under suspension or revocation.

SECTION 2

PRE-QUALIFICATION REQUIREMENTS FOR PERSONS DESIROUS OF BEING LICENSED FOR CONCRETE TESTING

2.1 EVALUATION

Field Concrete Technicians, subject to these Regulations, shall be examined and evaluated by the Massachusetts Construction Industry Board to determine the applicant's knowledge and ability to perform the following ASTM Standard Test Procedures:

- a. ASTM C172: Sampling Fresh Concrete
- b. ASTM C143: Test for Slump
- c. ASTM C31: Making and Curing Test Specimens in the Field
- d. ASTM C231: Test for Air Content - Pressure Method
- e. ASTM C173: Test for Air Content - Volumetric Method
- f. ASTM C138: Test for Weight per Cubic Foot (Density)
- g. ASTM C192: Storage and Transportation of Test Cylinders

The applicant's performance of these tests is to be observed and evaluated by three (3) qualified jurors designated by the Testing Agency (MCIB), using detailed data sheets. The said jurors' evaluations are appraised by the Certification Committee of the Testing Agency and reappraised by the Board of Trustees of the said Testing Agency. Three (3) categories of performance are to be used in the final evaluation process as follows:

1. PASS: The applicant has satisfactorily completed the examination.
2. PARTIAL: The applicant has failed one (1) of the five (5) performance tests and must take a partial re-test.
3. FAIL: The applicant has failed two (2) or more of the five (5) performance tests and must take a complete re-test.

SECTION 3 REVOCATION AND SUSPENSION PROCEDURES

3.1 REVOCATION AND SUSPENSION

The BBRS on its own initiative or upon the recommendation of the Construction Materials Safety Board or the Massachusetts Construction Industry Board, may suspend or revoke the license of any one so engaged in the practice of Concrete Testing found to be in noncompliance with these Rules and Regulations, this Code or the standards of good practice. Notice of suspension or revocation of such license shall be in writing with the reasons for suspension or revocation clearly set forth therein, and served in accordance with Section 121.2.1 of this Code.

3.2 NOTICE OF CONFERENCE

Prior to suspension, revocation or refusal to renew such license, written notice of such intent shall be served by the Pre-Qualifying Agency or BBRS in accordance with Section 121.2.1 of this Code. Within ten (10) calendar days of receipt of such notice, the affected licensee may request a conference before a three (3) member panel designated by the chairman of the said agency, who will hear facts and make their recommendations to the Pre-Qualifying Agency.

3.3 EFFECT OF

Upon suspension or revocation of the license, the licensee shall immediately cease engaging in the testing of concrete and concrete materials for use in buildings and structures which are subject to the provision of the State Building Code and no action brought before the State Building Code Appeals Board as specified in Section 4.1 of these Regulations or in any court of competent jurisdiction shall stay the said suspension or revocation unless said Appeals Board or court shall issue an order for a stay of the BBRS's suspension or revocation.

SECTION 4 APPEALS

4.1 MASSACHUSETTS STATE BUILDING CODE APPEALS BOARD

Any one engaged in the practice of Concrete Testing aggrieved by the suspension or revocation of their license or by an interpretation, order, requirement, direction or failure to act under these Rules and Regulations may appeal to the State Building Code Appeals Board as provided in Section 126 of this Code; however, entry of an appeal from the BBRS's order of revocation or suspension shall not stay such revocation or suspension unless so ordered by the said Appeals Board in a preliminary hearing conducted expressly for the purpose of a stay in accordance with that part of Section 126.3.2 of the Code dealing with the procedure required for a hearing on such stay.

780-CMR-3

MANUFACTURED BUILDINGS, BUILDING COMPONENTS AND MOBILE HOMES RULES AND REGULATIONS

FOREWORD

Contained herein are the RULES and REGULATIONS for Manufactured Buildings, Building Components and Mobile Homes of the Massachusetts Board of Building Regulations and Standards, hereinafter known as the BBRS. In accordance with MGL C143, the BBRS is authorized to adopt rules and regulations which govern how authorized programs are administered.

These Rules and Regulations were formerly in Appendix Q in Edition 4 of the Massachusetts State Building Code. For Edition 5, they were made a separate document to reduce the size of the basic code, as well as to make them more readily available to interested parties.

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MANUFACTURED BUILDINGS, BUILDING COMPONENTS AND MOBILE
HOMES RULES AND REGULATIONS

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**MANUFACTURED BUILDINGS, BUILDING COMPONENTS AND MOBILE
HOMES
780-CMR-3**

PART I GENERAL

**SECTION I
ADMINISTRATION**

1.1 TITLE

The BBRS, Massachusetts Board of Fire Prevention Regulations (Massachusetts Board of State Examiners of Electricians), and the Massachusetts Board of State Examiners of Plumbers and Gas Fitters herewith adopt the Rules and Regulations for Manufactured Buildings, Building Components and Mobile Homes.

1.2 DEFINITIONS

Unless otherwise expressly stated in the State Building Code, the following terms shall, for the purpose of these Rules and Regulations, have the meaning indicated in this section:

Approval: Approval by the State Board of Building Regulations and Standards (BBRS)

Building Component: Any subsystem, subassembly, or other system designed for use in or as part of a structure having concealed elements such as electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety.

Building System: Plans, specifications and documentation for a system of manufactured buildings or for a type or a system of building components, which may include structural, electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety, including variations which are submitted as part of the building system.

Certification: Any manufactured building, building component or mobile home which meets the provisions of the applicable Codes and Rules and Regulations pursuant thereto; and which has been labeled accordingly.

Code: The Commonwealth of Massachusetts State Building Code or Specialized Codes as defined herein.

Department - DPS: The Department of Public Safety, Division of Inspections.

Inspection Agencies: Independent agency, sometimes referred to as "third-party agency", retained by the manufacturer and approved by BBRS to perform inspections and evaluations of building systems, compliance assurance programs, manufactured buildings, and building components.

Installation: The process of affixing, or assembling and affixing a manufactured building, building component or mobile home on the building site, and connecting it to utilities, and/or to an existing building. Installation may also mean the connecting of two (2) or more mobile home units designed and approved to be so connected for use as a dwelling.

Label: An approved device or seal evidencing certification in accordance with the applicable Codes and Rules and Regulations promulgated pursuant thereto.

Local Enforcement Agency: A department or agency in a municipality charged with the enforcement of this Code and appropriate specialized codes which include, but are not limited to, the State Plumbing and Gas Fitting code and the State Electrical Code.

Manufactured Building: Any building which has concealed elements, such as electrical, mechanical, plumbing, fire protection, insulation, and other systems affecting health and safety, and which is manufactured or assembled in manufacturing facilities, on or off the building site. Also, any building as defined above which does not have concealed elements, but which has been approved by the BBRS at the request of the manufacturer. "Manufactured building" does not mean "mobile home".

Mobile Home: A structure, transportable in one (1) sections, which is eight (8) body feet or more in width and is thirty-two (32) body feet or more in length, and which is built on a permanent chassis, and designed to be used as a dwelling with permanent foundation, when connected to the required utilities, and includes the plumbing, heating, air-conditioning and electrical systems contained therein.

Specialized Code: All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts. The specialized codes shall include, but not be limited to, the State Plumbing and Gas Fitting Code and Electrical Code.

State Administrative Agencies: Boards, commissions, departments or agencies authorized to promulgate, adopt and amend codes and rules and regulations relating to buildings and structures and parts thereof and limited to the BBRS, Massachusetts Board of Fire Prevention Regulations, Massachusetts State Examiners

of Electricians, and the Massachusetts Board of State Examiners of Plumbers and Gas Fitters.

State Enforcement Agencies: Boards, commissions, departments or agencies authorized to enforce the provisions of the codes and rules and regulations which have been promulgated, adopted and amended and which relate to buildings or structures and parts thereof and limited to the Department of Public Safety, Massachusetts Board of State Examiners of Plumbers and Gas Fitters, and the Massachusetts State Examiners of Electricians.

1.3 SCOPE

- A. These Rules and Regulations govern the design, manufacture, handling, storage, transportation and installation of manufactured buildings, and building components intended for installation in this State and/or manufactured in this State for shipment to any other state in which such building, building components, or mobile homes and the labels thereon are accepted.
- B. The Federal Mobile Home Construction and Safety Standards promulgated by the Department of Housing and Urban Development govern the design, manufacture, handling, storage and transportation of mobile homes for installation in this state.
- C. Subject to local zoning ordinances and by-laws, manufactured buildings, building components or mobile homes may be sold for, delivered to, or installed on, building sites located in any jurisdiction of this State if such buildings, building components or mobile homes have been approved and certified pursuant to the applicable Codes and these Rules and Regulations.

1.4 ADMINISTRATION AND ENFORCEMENT

The BBRS and the State Enforcement Agencies shall enforce all provisions of these Rules and Regulations. The State Enforcement Agencies shall have the responsibility for evaluating and recommending approval to the BBRS of building systems, and for inspecting and recommending certification of manufactured buildings and building components for compliance with these Rules and Regulations and the applicable codes. The State Enforcement Agencies and the local enforcement agencies shall accept manufactured buildings, building components, building systems and compliance assurance programs labeled and certified by inspection agencies approved by the BBRS and those mobile homes certified as in conformance with the Federal standards by the application of the applicable required HUD label.

1.5 AUTHORIZATION OF THIRD PARTY INSPECTIONS

Upon recommendation of the State Enforcement Agencies, the BBRS may authorize inspection agencies, sometimes referred to as third party inspection agencies, to perform all or part of the inspection and certification of manufactured buildings and building components, building systems and compliance assurance programs, including either or both the issuance and the attachment of labels thereto. The BBRS may suspend or revoke any such authorization for cause.

1.6 APPROVALS AND COMPLIANCE

Upon the recommendation of the State Enforcement Agencies, the BBRS may approve building systems and compliance assurance programs which comply with the codes, standards, specifications and requirements and these Rules and Regulations.

1.7 TIME OF MANUFACTURE

For purposes of these regulations, a manufactured building, building component or mobile home is deemed to be manufactured at such time as the label is attached to it in accordance with the approved compliance assurance program.

1.8 RETROACTIVE CHANGES

No changes in the codes, standards, specifications and requirements of these Rules and Regulations shall apply retroactively.

1.9 AMENDMENTS

The State Administrative Agencies shall notify the BBRS, and the BBRS shall notify all interested parties including State Enforcement Agencies, inspection agencies, manufacturers with approved building systems, and local governmental jurisdictions of all amendments to these Rules and Regulations, and each manufacturer shall have no more than 180 days following the sending of notification to submit to the BBRS compliance assurance program revisions in order to comply with such amendments. Where imminent danger to life safety is involved, the State Administrative Agencies may require that immediate effect be given such amendments to the codes, standards, specifications and requirements so adopted.

SECTION 2 COMPLIANCE ASSURANCE PROGRAMS

2.1 APPROVAL

In order to obtain approval for manufactured buildings or building components a manufacturer shall submit a building system for evaluation to the BBRS for approvals in accordance with these Rules and Regulations.

2.2 SUITABILITY

Prior to a full evaluation, the State Enforcement Agencies shall determine that building systems and/or the application for approval of the compliance assurance program submitted to it are suitable for processing. In the event that the application is found to be unsuitable for processing, the applicant shall be notified in writing of such unsuitability and the basis thereof, within thirty (30) days of the date the application is received by the BBRS. In such event, all but twenty-five (\$25) dollars of the fee will be returned and the findings of unsuitability will be without prejudice. Any subsequent submission shall be treated as a new application.

2.3 REQUISITES

The State Enforcement Agencies may require tests to determine whether a compliance assurance program meets the codes, standards and requirements of the evaluation of plans, specifications and documentation. The procedures used shall be reviewed and evaluated by the BBRS in accordance with these Rules and Regulations. The costs of such tests shall be borne by the applicant.

2.4 NOTIFICATION OF DISAPPROVAL

In the event a compliance assurance program is disapproved by the BBRS, the BBRS shall notify the applicant with a written explanation of the reasons for such disapproval thereto.

2.5 APPROVAL - EVIDENCE

Approval of a compliance assurance program shall be evidenced by a letter of certification issued by the BBRS.

2.6 APPROVAL - REPORT

The State Enforcement Agencies shall prepare and the BBRS shall issue to the applicant a building system approval report which shall include therein any conditions imposed for its use.

2.7 APPROVAL - VARIATIONS

A building system and compliance assurance program or any amendment there to which has been approved, shall not be varied in any way without prior written authorization by the BBRS. All amendments shall be in writing and shall be made a part of the written record of the approval.

2.8 AMENDMENTS - PROPOSED

Amendments to compliance assurance programs may be proposed by submitting to the BBRS for its approval, appropriate plans, specifications, or documentation showing the effect of the proposed amendment on each building system and the required fee.

2.9 COMPLIANCE ASSURANCE PROGRAM

A manufacturer shall obtain approval from the BBRS of a compliance assurance program for his building system. Buildings or building components shall be manufactured in accordance with an approved program in order to be certified. Compliance assurance programs shall be submitted to the BBRS for its approval in accordance with these Rules and Regulations.

SECTION 3 CERTIFICATION

Manufactured buildings or building components or mobile homes, accepted by the State Enforcement Agencies and an inspection agency as having been manufactured according to an approved building system and an approved compliance assurance program, shall be certified by the BBRS upon the recommendation of the State Enforcement Agencies as complying with the requirements of the applicable codes and these Rules and Regulations. Certification shall be evidenced by the attachment of a label to each certified manufactured building or building component (or groups of components).

3.1 MANUFACTURER'S DATA PLATE

3.1.1 CONTENTS

The following information shall be placed directly or by reference on one (1) or more permanent manufacturer's data plates in the vicinity of the electrical distribution panel, or in some other designated location acceptable to the State Enforcement Agencies, on the manufactured building or building component where it will be readily accessible for inspection:

- a) Manufacturer's name and address;
- b) Serial number of the unit;
- c) Label serial number;
- d) Name and date of applicable building, plumbing, gas and electrical codes and issue of their accumulative supplements complied with;
- e) Model designation and name of manufacturer of major factory-installed appliances;
- f) Identification of permissible type of gas for appliance and directions for water and drain connection;
- g) Snow, wind, seismic and other live loads;
- h) Electrical ratings - instructions and warnings on voltage;
- i) Special conditions or limitations on use of the units, including unsuitability for areas in which specified environmental conditions prevail;
- j) Methods of assembly or joining multiple units;
- k) Type of construction, including fire rating, occupancy class, and interior finish flame spread class;
- l) Building height and story limitation;
- m) Floor area; and
- n) Minimum side yard requirements for fire rating.

If, in the opinion of the State Administrative Agencies, the shape or size of a building component is such that this information cannot be attached to it permanently, the information may be placed in a manual crated with the component or on a tag attached to the crate in which the component is shipped, if the information is not such that the future occupant of the building should know it. If the occupant will need to know the information, it shall be contained in a manual which shall be presented to the occupant upon transfer of possession. If life safety is involved, the item in question shall be plainly labeled.

3.2 LABELS

Each manufactured building or building component which is certified pursuant to the applicable codes and these Rules and Regulations, shall have permanently attached thereto, in a visible location as shown on the approved building system, an approved label which cannot be removed therefrom without destroying such label.

3.2.1 CONTENTS

An approved label shall bear the following information:

- a) "This label certifies that this building (or building component) has been manufactured in accordance with an approved building system and compliance assurance program approved by the Commonwealth of Massachusetts Board of Building Regulations and Standards and inspected by _____.";
- b) Label serial number;
- c) Building system approval number;
- d) Manufacturer's serial number;
- e) The words "See data plate located on _____."; and
- f) Date of manufacture.

At the direction of the BBRS labels and data plates may be limited in size and content for components whose shape and size does not permit the full information to be placed thereon.

3.2.2 ISSUANCE

The approved label shall be issued by the BBRS or its agents in accordance with the following:

- a) If the BBRS delegated the issuance of labels to an inspection agency, the agency shall be required to obtain approval from the BBRS for the manner in which they are handled;
- b) Labels must be serially numbered;
- c) A manufacturer's compliance assurance program submitted in accordance with the Rules and Regulations hereof, shall include requirements for issuance, possession of, attachment of and accounting for all labels to assure that labels are attached only to building, building components, or mobile homes manufactured pursuant to an approved building system and inspected pursuant to an approved compliance assurance program; and
- d) Upon request of the inspection agency, the BBRS may determine that the manufacturer's record of compliance is such that the inspection agency need not maintain an inspector in a given plant at all time,s inspection agency may entrust labels to the custody of one (1) or more employees of the manufacturer, who shall be charged with controlling the use of the such labels. Such employees shall not be given custody of more labels than are necessary. If the conditions of custody are violated, the BBRS or an inspection agency shall immediately regain possession of all labels that have not been applied to the manufactured buildings or building components and shall take such further action with respect to future labeling, as it may deem necessary to assure compliance with the applicable codes and these Rules and Regulations.

3.3 RECORDS OF LABELS

Permanent records shall be kept of the handling of all labels, indicating at least how may labels have been applied to buildings or building components (or groups of components), which labels have been applied to which buildings or building components, the disposition of any damaged or rejected labels, and the location and custody of all unused labels. Such records shall be maintained by the manufacturer or by the inspection agency. A copy of such records covering attachment of each label shall be sent to the BBRS on the tenth of each month and the BBRS shall forward all such records to the State Enforcement Agencies.

3.4 ATTACHMENT OF LABELS

The inspection agency shall attach in consecutive numerical sequence labels to buildings or building components manufactured in accordance with an approved building system and meeting the requirements of an approved compliance assurance program.

Manufacturers shall attach labels in the same manner to manufactured buildings or building components manufactured in accordance with an approved building system and meeting the requirements of an approved compliance assurance program.

3.5 SUSPENSION AND REVOCATION

The State Enforcement Agencies or an inspection agency may suspend or revoke, or cause to be suspended or revoked, the certification of any manufactured building or building component which the State Enforcement Agencies or an inspection agency finds not to comply with the applicable codes or these Rules and Regulations, or which has been manufactured pursuant to a building system or a compliance assurance program for which approval has been suspended or revoked, or which has not been manufactured in accordance with the approved compliance assurance program. The State Enforcement Agencies or an inspection agency shall remove or cause to be removed, labels from any such manufactured building, building component or mobile home until it is brought into compliance with the applicable codes and these Rules and Regulations. Notice of suspension or revocation of certification shall be in writing with the reasons for suspension or revocation clearly set forth therein.

- a) Upon suspension or revocation of the approval of any building system or compliance assurance program, no further labels shall be attached to any manufactured buildings or building components manufactured pursuant to the building system or compliance assurance program with respect to which the approval was suspended or revoked. Upon termination of such suspension or revocation, labels may again be attached to the manufactured building or buildings component manufactured after the date approval was reinstated. Should any building or building component have been manufactured during the period of suspension or revocation, it shall not be labeled unless the State Enforcement Agencies or inspection agency have inspected such building or building component and is satisfied that all requirements for certification have been met. If the State Enforcement Agency acts under this section, it must notify the inspection agency.
- b) The manufacturer shall return all labels allocated for a manufactured building or building component to the BBRS no later than thirty (30) days from the effective date of any suspension or revocation of the State Enforcement Agencies or inspection agency, of the building system or compliance assurance program pursuant to which the manufactured building or building component is being manufactured. The manufacturer shall also return to the BBRS all labels which it determines for any reason are no longer needed.

3.6 VARIATIONS OF CERTIFIED UNITS

Manufactured buildings, building components or mobile homes certified and labeled pursuant to the applicable codes and these Rules and Regulations shall not be varied in any way prior to the issuance of a certificate of occupancy without resubmission to the BBRS for its approval of the variation and of the unit which includes the variation. The State Enforcement Agencies or an inspection agency shall inspect the building, building component or mobile home wherever it is located and such inspection may include such tests or destructive or nondestructive disassembly as the State Enforcement Agencies or an inspection agency deems necessary to assure compliance with the applicable Codes and these Rules and Regulations. Local Enforcement Agencies may be designated by the BBRS or State Enforcement Agencies as inspection agencies for such purposes.

SECTION 4**INSPECTION BY THE STATE ENFORCEMENT AGENCIES OR THEIR AGENTS**

The State Enforcement Agencies shall make, or cause to be made, such inspections of the entire processing of manufacturing, certifying, handling, storing and transporting of manufactured buildings or building components produced pursuant to approved building systems as they deem necessary.

4.1 INSPECTION OF FACILITIES

As part of the process of evaluating building systems and compliance assurance programs, the State Enforcement Agencies shall inspect, or cause to be inspected, the manufacturing facilities in which the buildings or building components are to be manufactured.

4.2 INSPECTION ACCORDING TO COMPLIANCE ASSURANCE PROGRAMS

The State Enforcement Agencies or an inspection agency shall make such inspections as may be required by an approved compliance assurance program, or as may be deemed necessary by the State Enforcement Agencies.

4.3 INSPECTION OF DAMAGED COMPONENTS

Prior to the issuance of a certificate of occupancy, the State Enforcement Agencies or an inspection agency shall inspect, or cause to be inspected, certified manufactured buildings or building components which it determines to have been sufficiently damaged after certification to warrant such inspection and to take such action with regard to such buildings or building components as is authorized hereof, or as is otherwise necessary to eliminate dangerous conditions. The local

enforcement agencies may be designated by the BBRS or the State Enforcement Agencies as the inspection agency.

4.3.1 REPAIRING DAMAGED COMPONENTS

The State Enforcement Agencies or an inspection agency shall require manufactured buildings or building components which are so damaged as to no longer comply with the applicable Codes and these Rules and Regulations, to be repaired and made to comply within a reasonable time; or if they are so damaged that they cannot be brought into compliance, the State Enforcement Agencies or inspection agency shall order that the labels be removed from such buildings, building components or mobile homes. A report under this section shall be filed with the inspection agency, BBRS and State Enforcement Agency.

4.3.2 IRREPARABLY DAMAGED COMPONENTS

Irreparably damaged buildings or building components shall be disposed of by the manufacturer.

4.4 MONITORING INSPECTION AGENCY

The State Enforcement Agencies or their designated agents shall examine each approved inspection agency, at any reasonable time, and without prior announcement, in order to monitor the reliability of each agency and of its monitoring of each compliance assurance program,. Each such examination shall investigate the adequacy of all procedures used by the agency in monitoring compliance assurance programs including inspection, tests, production methods, process controls, operator performance, materials, receipts, storage and handling, workmanship standards, records and all other activities which implement the compliance assurance program in the manufacturing facility, during transport, on-site, and at critical subcontractors' facilities. The results of such examinations shall be filed with the office of the BBRS. Copies of such reports shall be sent to the inspection agency and the State Enforcement Agencies. Inspection agencies shall be specifically notified by the BBRS of any deficiencies and of the manner and time by which such deficiencies must be eliminated. If deemed necessary by the State Enforcement Agencies an inspection agency's approval may be suspended or revoked by the BBRS as provided herein.

4.4.1 PRIOR TO APPROVAL

Such examinations may also be conducted before approving an inspection agency.

4.5 INSPECTION BY DISASSEMBLY

No inspection entailing disassembly, damage to or destruction of certified manufactured buildings, building components or mobile homes shall be conducted except to implement these Rules and Regulations.

SECTION 5 LOCAL ENFORCEMENT AGENCY PROCEDURES AND INSPECTIONS

5.1 PERMIT APPLICATIONS

Upon application in conformity with the provisions of the appropriate codes, local enforcement agencies shall issue appropriate permits for certified manufactured buildings, building components or mobile homes prior to installation, and shall not withhold approval of the appropriate permits for buildings containing certified building components which in all other respects comply with all applicable Codes, provided that any manufactured buildings, building components or mobile homes found by the State Enforcement Agencies not to comply with the appropriate codes or these Rules and Regulations shall be brought into compliance before such permit shall be issued. An application to local enforcement agencies for an appropriate permit shall, when requested, in addition to any other requirements contain:

5.1.1 PERMIT APPLICATION - STATEMENT OF CONTENT

A statement that the work to be performed under such permit is to include the installation of a certified manufactured building, building component or mobile home in accordance with the provisions of the applicable codes, the statement to be signed by the applicant or his agent, with the appropriate address.

5.1.2 PERMIT APPLICATION - BUILDING SYSTEM

A true copy of the approved building system with respect to which the manufactured building or building component was manufactured or is to be manufactured, where one has not previously been furnished to that local enforcement agency.

5.1.3 PERMIT APPLICATION - BUILDING SYSTEM APPROVAL

A copy of the Building System Report, as approved by the BBRS, where it has not previously been furnished to the Local Enforcement Agency.

5.2 INSPECTION OF SITE PREPARATION AND SERVICE CONNECTIONS

Appropriate local enforcement agencies shall inspect site preparation work including foundations, not within the scope of the approval and certification, and the structural, mechanical, plumbing and electrical connections among units, for compliance with applicable law, rules and regulations.

5.3 COMPLIANCE WITH INSTRUCTIONS

Appropriate local enforcement agencies shall inspect all manufactured buildings, building components or mobile homes upon, or promptly after, installation at the building site to determine whether all instructions in the Building System Approval Report or conditions listed on the manufacturer's data plate have been followed.

This may include tests for tightness of plumbing and mechanical systems, and for malfunctions in the electrical system and a visual inspection for obvious nonconformity with the approved building system.

5.3.1 DISASSEMBLY PROHIBITED

Unauthorized destructive disassembly of certified buildings and building components and mobile homes shall not be performed in order to conduct such tests or inspections, except as provided in section 4.3, nor shall there be imposed standards or test criteria different from those adopted by the State Enforcement Agencies or specified in the Building System Approval Report, or the "HUD's" Mobile Home Construction and Safety Standards.

5.3.2 OPENING PANELS

Nondestructive disassembly may be performed only to the extent of opening access panels and cover plates.

5.4 DISPOSITION OF NONCOMPLYING NEW UNITS

Local enforcement agencies shall require the manufacturer to dispose of noncomplying manufactured buildings and building components after consultation with the State Enforcement Agencies and reasonable notice to the manufacturer or owner thereof, as the case may be, of the proposed disposition.

5.5 CERTIFICATES OF OCCUPANCY

Appropriate local inspectors shall issue certificates of occupancy for certified manufactured buildings and mobile homes containing certified building components which otherwise comply with all the applicable codes, after they have been installed

and inspected pursuant to the applicable codes and these Rules and Regulations, provided that any manufactured building or building component found not to comply with the Building System Approval Report or any mobile home found not to comply with "Hud's" Mobile Home Construction and Safety Standards shall be brought into compliance before such certificate of occupancy shall be issued.

5.6 REPORTING OF VIOLATIONS TO DEPARTMENT OF PUBLIC SAFETY

When any local enforcement agency is making an inspection and finds violations or suspected violations, it shall report the details of the violations in writing to the Department. Where violations are hazardous to occupants, a certificate of occupancy shall not be issued and the building shall not be occupied before such hazards are corrected. If the violations are not hazardous, a provisional certificate of occupancy may be issued. The Department shall forward all such reports of violations to the BBRS and the State Enforcement Agencies.

SECTION 6 FEES

6.1 DEPOSIT FOR APPLICATION TO THE BBRS

A deposit shall be required upon application to the BBRS to perform any of the functions in these Rules and Regulations.

6.2 ESTABLISHMENT OF FEES

Fees charged by the BBRS for functions performed shall be in accordance with the fee schedule established by the Commonwealth of Massachusetts as specified in Part VI, Section 18 of these Rules and Regulations.

SECTION 7 NOTIFICATION OF CHANGES IN NAME, ADDRESS, OWNERSHIP OR LOCATION

7.1 NOTIFICATION BY MANUFACTURERS

Manufacturers shall notify the BBRS in writing within ten (10) days of any of the following occurrences:

- a) The corporate name is changed;
- b) The main address of the company is changed;

- c) There is a change in twenty-five (25) percent or more of the ownership interest of the company within a twelve (12) month period;
- d) The location of any manufacturing facility is changed;
- e) A new manufacturing facility is established; or
- f) There are changes in principal officers of the firm.

The BBRS shall notify the State Administrative Agencies of such occurrences.

7.2 NOTIFICATION BY INSPECTION AGENCIES

Inspection agencies shall notify the BBRS in writing within ten (10) days of any of the following occurrences:

- a) The company name is changed;
- b) The main address of the company is changed;
- c) There is a change in twenty-five (25) percent or more of the ownership interest or control of the company within a twelve (12) month period;
- d) The location of any testing facility is changed;
- e) A new testing facility is established; or
- f) There are changes in principal officers and key supervisory and responsible personnel of the firm.

The BBRS shall notify the State Administrative Agencies of such occurrences.

SECTION 8 PROPRIETARY INFORMATION

All information relating to building systems and compliance assurance programs which the manufacturer or other party considers proprietary shall be so designated by him at the time of its submission, and shall be so held by the State Enforcement Agencies and State Administrative Agencies, except as the State Administrative Agencies determine in each case, that disclosure is necessary to carry out the purposes of the applicable codes and these Rules and Regulations.

**PART II REQUIREMENTS FOR SUBMISSION OF BUILDING SYSTEMS AND
COMPLIANCE ASSURANCE PROGRAMS**

**SECTION 9
BUILDING SYSTEMS**

Building systems shall meet the requirements set forth below to be evaluated for compliance with the standards, specifications and requirements adopted by the State Administrative Agencies.

9.1 GENERAL REQUIREMENTS

9.1.1 PLANS, SPECIFICATIONS AND DOCUMENTATION

Building systems, including all plans, specifications and other documentation, shall be submitted in quadruplicate to the BBRS who shall act as the depository and disbursing officer of all such items. The BBRS shall forward to the appropriate State Enforcement Agencies plans, specifications and documentation for their recommendations.

9.1.2 FORM AND FEES

Building systems shall be submitted in the form prescribed by the BBRS and shall be accompanied by all required fees.

9.1.3 IDENTIFICATION

All documents submitted with the application shall be identified to indicate the manufacturer's name, office address and address of the manufacturing facility.

9.1.4 PLANS SHOWING ELEMENTS

Plans shall be submitted showing all elements relating to specific systems on properly identifiable sheets.

9.1.5 APPLICATION - APPROVED ARCHITECT OR ENGINEER

Each building system application shall bear the signature and seal of an approved registered architect or registered professional engineer certifying that the building system complies with the applicable codes and standards promulgated herein.

9.1.6 ON-SITE WORK IDENTIFIED

All work to be performed on-site, including connection of all systems, equipment and appliances, shall be identified and distinguished from work to be performed in the manufacturing facility.

9.1.7 SPACE FOR STATE ADMINISTRATIVE AGENCIES APPROVAL STAMP

A 3" x 4" blank rectangular space shall be provided on all sheets of plans near the title box for the BBRs's stamp of approval.

9.1.8 MATERIAL GRADE AND QUALITY

Grade, quality and identification of all material shall be specified.

9.1.9 CALCULATIONS AND TEST REPORTS

Design calculations and test reports shall be specified.

9.1.9.1 DRAWINGS TO SCALE

Drawings shall be drawn to scale and be legible.

9.1.9.2 LABEL AND DATA PLATE LOCATION

Drawings shall indicate the location of the approved label and data plate.

9.1.9.3 DRAWINGS DATED AND IDENTIFIED

Drawings shall be dated and identified. The number of sheets in each set shall be indicated.

9.2 REQUIRED CONSTRUCTION DETAILS

Building systems for manufactured buildings shall provide or show, but not be limited to, the details listed below including the method of their testing or evaluation, or both. These requirements shall apply to the building systems for building components only to the extent deemed necessary by the State Enforcement Agencies to permit a proper evaluation of the building component.

9.2.1 GENERAL

- a) Details and methods of installation of manufactured buildings or building components on foundations and/or to each other.
- b) All exterior elevations.
- c) Cross sections as necessary to identify major building components.
- d) Details of flashing, such as at openings and at penetrations through roofs and subcomponent connections. Indicate flashing material and gauge to be used.
- e) Attic access and attic ventilation.
- f) Exterior wall, roof and soffit material as well as finish.
- g) Interior wall and ceiling finish material.
- h) Fire separation walls.
- i) Sizes, locations and types of doors, windows and fire/smoke detectors.
- j) Recommended foundation plans, vents and underfloor access.

9.2.2 BUILDING CLASSIFICATION

- a) Occupancy or use.
- b) Area, height, and number of stories.
- c) Type of construction.
- d) Fireresistance ratings.

9.2.3 SPACE AND FIRE SAFETY

- a) Details of fire resistance rated assemblies for all stairway enclosures, doors, walls, floors, ceilings, partitions, columns, roof and shaft enclosures.
- b) Detail of Fire Protection Systems.
- c) Details as to width of all aisles, exits, corridors, passageways and stairway enclosures.

- d) Toxicity and flame spread classification of finished materials.

9.2.4 STRUCTURAL DETAIL REQUIREMENTS

- a) Engineer's calculations of structural members, where appropriate.
- b) Structural and framing details of all floors, roof and walls.
- c) Details and stress diagrams of roof trusses.
- d) Details of reinforcing steel.
- e) Complete loading schedule.
- f) Column loads and column schedule.
- g) Lintel schedule.
- h) Size, spacing and details of all structural elements.
- i) Grade or quality of all structural elements (lumber, steel, etc.).
- j) Elevation of structural elements, walls or sections thereof, providing resistance to vertical loads or lateral forces.
- k) Complete details of all structural connections.

9.2.5 MECHANICAL DETAIL REQUIREMENTS

- a) Location of all equipment and appliances. Indicate equipment and appliances listed or labeled by approved agencies.
- b) Heat loss and heat gain calculations.
- c) Manufacturer's name, make, model, number, BTU, input and output rating of all equipment and appliances, as appropriate, or the equal thereof.
- d) Duct and register locations, sizes, and materials.
- e) Clearances from combustible material or surfaces for all ducts, flues and chimneys.
- f) Method of providing required combustion air and return air.

- g) Location of flues, vents and chimneys and clearances from air intakes and other vents and flues.
- h) Details regarding dampers in ducts penetrating fire separations.
- i) Complete drawings of fire sprinkler system, standpipe system or smoke/fire alarm system as required.
- j) Detail of elevator or escalator system, including method of emergency operation.
- k) Duct and piping insulation thickness.
- l) Ventilation air calculations.

9.2.6 PLUMBING DETAIL REQUIREMENTS

- a) Plan or schematic drawing of the plumbing layout, including but not limited to, size of piping, fitting, traps and vents, cleanouts and valves, gas, water, and drainage system.
- b) Plumbing materials, and location of all equipment and appliances to be used. Indicate fixture unit capacity of system(s) and the make, model, and rating/capacity of equipment and appliances. Indicate equipment and appliances listed or labeled by approved agencies.
- c) Make and model of safety controls (such as for water heaters), their location, and whether listed or labeled by approved agencies.
- d) How piping is to be supported and intervals of support.
- e) Location of vents above roofs and required clearances, including but not limited to clearances from air intakes, other vents and flues.
- f) Methods of testing.

9.2.7 ELECTRICAL DETAIL REQUIREMENTS

- a) Plan of service equipment, including service entrance, conductors, service raceway and clearances above ground and above structures.
- b) Method and detail for grounding service equipment.
- c) Single line diagram of the entire electrical installation.

- d) Load calculations for service and feeders.
- e) Sizes of all feeders and branch circuits.
- f) Size, rating and location of main disconnect/overcurrent protective devices.
- g) Method of interconnection between manufactured buildings or building components and location of connections.
- h) Location of all outlets and junction boxes.
- i) Method of mounting fixtures and wiring installations.
- j) Lighting power calculations.

SECTION 10

COMPLIANCE ASSURANCE PROGRAMS FOR MANUFACTURED BUILDINGS AND BUILDING COMPONENTS

Compliance assurance programs shall be approved if they meet the requirements set forth in this section. It is the manufacturer's responsibility to execute every aspect of this program. The manufacturer shall continue to be responsible for all corrective actions required and the contractual relationship between the manufacturer and the inspection agency shall not diminish such responsibility. The manufacturer shall cooperate with the inspection agency by providing the inspection agency with all necessary reports, information, documents, records, facilities, equipment, samples and other assistance for assuring compliance.

The manufacturer's compliance assurance program shall be submitted to the BBRS in the form of a compliance assurance manual which shall contain complete documentation of all compliance assurance activities of both the manufacturer and the inspection agency. The manual shall be comprehensively indexed, and shall treat the material listed here in detail, as follows:

10.1 ORGANIZATION REQUIREMENTS:

- a) A procedure for periodic revision of the manual;
- b) An organizational structure for implementing and maintaining the compliance assurance program and its functional relationship to other elements of the organization structure of the manufacturer, which structure shall provide for independence from the production department;

- 1) Company officers and employees in charge of the compliance assurances program must be identified, and their training and qualifications specified;
- c) A uniform system of audit (in-depth analysis of program effectiveness and means to identify deficiencies) to monitor program performance periodically;
- d) Complete and reliable records of manufacturing and site operations, if any (suitable means of storage, preservation and accessibility of copies of forms to be utilized shall be included);
- e) A system to control changes in production or inspection procedures;
- f) A system to assure that working drawings and specifications, working instructions and standards, procurement documents, etc. conform to the approved building system;
- g) A serial number system for buildings or building components; and
- h) The method of safekeeping, handling and attaching labels and identification of those employees responsible therefor.

10.2 MATERIALS CONTROL

- a) Procedure to assure effective control over procurement sources to ensure that materials, supplies and other items used in production and site operations, if any, conform to the approved plans, specifications and quality requirements;
- b) Procedures for inspection of materials, supplies and other items at the point of receipt;
- c) Method of protection of materials, supplies and other items against deterioration prior to their incorporation in the certified buildings or building component; and
- d) Provision for disposal of rejected materials, supplies and other items.

10.3 PRODUCTION CONTROL

- a) Procedures for timely remedial and preventive measures to assure product quality;

- b) Provision, maintenance and use of testing and inspection;
- c) Provision for frequency of sampling inspections;
- d) Provision of necessary authority to reject defective work and carry out compliance assurance functions, notwithstanding any conflict with production department goals and needs;
- e) A schematic of the manufacturing operation showing the location of inspection stations, and "hold" points for mandatory inspection characteristics;
- f) Inspection and test procedures, including accept/reject criteria and mandatory inspection characteristics;
- g) Standards of workmanship; and
- h) Provision of disposal of rejects.

10.4 FINISHED PRODUCT CONTROL

- a) Procedure for final inspection of all manufactured buildings or building components before shipment to the site or storage point, including identification and labeling;
- b) Procedures for handling and storing all finished manufactured buildings or building components, both at the manufacturing plant or other storage point and after delivery to the building site;
- c) Procedures for packing, packaging and shipping operations and related inspections; and
- d) Procedures for transportation, including all measures to protect against damage while in transit, and setting forth the modes of transportation to be utilized and the carrying equipment and procedures.

10.5 INSTALLATION CONTROL

- a) Installation procedures including component placement, equipment and procedures, field erection and finishing work, utility connection instructions and all appropriate on-site inspection criteria and test descriptions; and
- b) Organizational provisions for field repair and disposal of rejects.

10.6 PERMISSION FOR INSPECTION

The manufacturer shall provide the BBRS with written permission, signed and notarized, for the State Enforcement Agencies to inspect his manufacturing facilities, his products, and building sites under his control at any reasonable time without prior announcement.

10.7 INSPECTIONS BY THE STATE ENFORCEMENT AGENCIES

The Compliance Assurance Manual shall contain detailed plans for inspections by the State Enforcement Agencies or inspection agency.

PART III APPROVAL OF INSPECTION AGENCIES**SECTION 11
REQUIREMENTS FOR SUBMISSION**

An inspection agency seeking approval shall submit a quadruplicate application to the BBRS which shall include the items listed in this section.

11.1 ARTICLES OF INCORPORATION

The original Articles of Incorporation of the agency and all subsequent amendments thereto, as filed in the State of Incorporation.

11.2 BY-LAWS

The by-laws of the organization, if any.

11.3 BUSINESS AFFILIATIONS OF MEMBERS

The names, addresses and business affiliations of all members of the Board of Directors and of top management personnel.

11.4 STOCK OWNERSHIP

Individual interests representing more than ten (10) percent of the outstanding ownership reflecting the financial interest of the agency's Board of Directors and top management personnel.

11.5 CERTIFICATIONS

Certification by the agency that:

- a) Its Board of Directors, as a body, and its technical personnel, as individuals, can exercise independence of judgment; and
- b) Its activities pursuant hereto will result in no financial benefit to the agency via stock ownership, or other financial interests in any producer, supplier or vendor of products involved, other than through standard published fees for services rendered.

11.6 EXPERIENCE OF DIRECTORS

Names, years of experience, state in which professionally registered and other qualifications of the directors of inspection or evaluation programs.

11.7 EXPERIENCE OF EMPLOYEES

Names and years of experience of employees practicing in the following disciplines: architecture, structural engineering, mechanical engineering, electrical engineering, fire protection and other branches of engineering; the state in which each is registered and the service each performs.

11.8 ORGANIZATION CHART

An organization chart showing management and supervisory persons including the number of graduate engineers and architects, and the names of all consulting engineers or architects, designating which are full-time and which are part-time employees.

11.9 NUMBER AND LOCATION OF PERSONNEL

Number and location of factory inspectors, supervisors, and other technicians, including evaluators of factory inspectors and the qualifications of each specialized group, including records of work experience, licenses held and other pertinent qualifications; description of types of work each group and each technician is expected to perform and the qualifications of each group and each technician to perform the work assigned.

11.10 EMPLOYEES TRAINING PROGRAMS

An outline of the training program, if any, of the agency to assure that all inspectors, evaluators and other technicians are properly trained to do each job assigned to them.

11.11 EMPLOYEE SUPERVISION

An outline of the general procedures for supervision of inspectors and evaluators, including checking and evaluation of their work.

11.12 NON-EMPLOYEES RELATIONSHIPS

All engineers, technicians and other personnel who will perform services for the organization but who are not employees of the organization, and the supervisory and other relationships which each will have to the agency.

11.13 PRODUCTS EVALUATED

Type of products, components, equipment, structures and other items which the organization has evaluated, tested or inspected and the number of years of experience the organization has had with each, and the type of codes, standards, specifications and requirements with respect to which the organization has had experience in providing evaluation, inspection or testing services, and the number of years experience with each.

11.14 FREQUENCY CAPABILITY

Description of the frequency with which the agency is capable of performing inspections or evaluations.

11.15 STATE APPROVED IN

List of the states in which the agency is now approved to inspect or evaluate manufactured buildings or building components or parts thereof for compliance with approved building systems.

**SECTION 12
PROCEDURES FOR APPROVING INSPECTION AGENCIES****12.1 QUALIFICATIONS**

Upon the recommendation of the State Enforcement Agencies, the BBRS may approve inspection agencies which meet the requirements of the applicable codes

and these Rules and Regulations and which the State Administrative Agencies find otherwise qualified to perform the functions proposed to be delegated to them.

12.2 SUITABILITY OF APPLICATION

Prior to a full evaluation of an application for approval, the BBRS shall determine whether such application is unsuitable for processing. In the event the application is found to be unsuitable for processing, the applicant shall be notified in writing of such unsuitability and the basis thereof within thirty (30) days of the date of the application is received by the BBRS.

In such event, all but twenty-five (\$25.00) dollars of the fee will be returned, and the rulings of unsuitability shall be without prejudice. Any subsequent submission shall be treated as a new application.

12.3 APPROVALS

In the event of approval of the BBRS, an inspection agency shall be notified by a letter from the BBRS indicating such approval and stating specifically the functions which the applicant has been approved to perform. Such approval shall not constitute the actual delegation of such functions.

SECTION 13 SUSPENSION AND REVOCATION

13.1 GROUNDS

The BBRS may suspend or revoke its approval of any inspection agency if the approval was issued in error; was issued on the basis of incorrect information; was issued in violation of any of the applicable Codes or these Rules and Regulations; if the inspection agency violates any of the applicable Codes or these Rules and Regulations; if examination discloses that the agency failed to perform properly; or for such other cause as may be deemed sufficient by the State Enforcement Agencies to warrant such action.

13.2 PROCEDURES

13.2.1 GENERAL

If the BBRS suspends or revokes the approval of an inspection agency, the inspection agency shall be given notice in writing from the BBRS of the suspension or revocation with the reasons therefore set forth therein. Manufacturers being evaluated or inspected by such agencies, all local enforcement agencies within this State, and the State Enforcement Agencies shall also be notified in writing of such

suspension or revocation. Such notices shall contain instructions to the manufacturer and to the local enforcement agency as to the procedures to be followed regarding manufactured buildings or building components previously certified by an agency whose approval has been suspended or revoked.

13.2.2 RECORDS

An inspection agency whose approval has been suspended or revoked shall within ninety (90) days of the suspension or revocation deliver to the custody of the BBRS the originals of all records required to be maintained during the course of the inspection agency's operations pursuant to the applicable codes and these Rules and Regulations.

13.2.3 LABELS

An inspection agency for which approval has been suspended or revoked shall within ninety (90) days of the suspension or revocation deliver to the custody of the BBRS all labels in the agency's possession, under its control, or for which it is responsible pursuant to the applicable codes and these Rules and Regulations.

PART IV RECIPROCITY

If the BBRS finds that the standards for the manufacture and inspection of manufactured buildings or building components prescribed by statute or rules and regulations of another state, governmental agency or private agency meet the objectives of the applicable codes and these Rules and Regulations, and are enforced satisfactorily by such other state or other agency, or by their agents, the State Enforcement Agencies shall accept manufactured buildings or building components which have been certified by such other state or other agency, and the BBRS shall assure or be assured that the appropriate label is attached thereto. The standards of another state or agency shall not be deemed to adequately be enforced unless such other state or agency provides for notification to the Department of suspensions or revocations of approvals issued by that other state or agency in a manner satisfactory to the BBRS and State Enforcement Agencies and so notify the BBRS. The BBRS shall notify the State Enforcement Agencies of any action taken under this section.

SECTION 14
PROCEDURES FOR GRANTING OR REFUSING RECIPROCITY TO
ANOTHER JURISDICTION

14.1 EVALUATION

The State Enforcement Agencies may evaluate the statute, codes, rules and regulations of another state or other state or other agency at any time.

14.2 METHODS OF EXTENDING RECIPROCITY

If the BBRS find that the standards prescribed by the statute or rules and regulations of another state or another agency meet the objectives of the appropriate codes and that these rules and regulations are satisfactorily enforced, it may upon the recommendation of the State Enforcement Agencies, as provided in Section 2.1, extend reciprocity to that jurisdiction by:

- a) Giving notice to any requesting manufacturer;
- b) Giving notice to the Administrative Agency of the other jurisdiction;
- c) Giving notice to the State Enforcement Agencies and all local enforcement agencies in this state.

14.3 REJECTIONS

If the standards of the other state or other agency do not meet the objectives of the appropriate codes or are inadequately enforced, or both, reciprocity shall not be extended. In that event, the BBRS shall notify any requesting manufacturer and the Administrative Agency of the other state or other agency of the refusal and the reasons therefore.

SECTION 15
PROCEDURES FOR RECIPROCITY CERTIFYING MANUFACTURED
BUILDINGS OR BUILDING COMPONENTS

A manufacturer from a jurisdiction to which reciprocity has been extended shall submit to the BBRS evidence that his building system and compliance assurance program have been approved by such state or other agency. The BBRS shall verify the approval and shall notify the State Enforcement Agencies, local enforcement agencies and the manufacturer in writing of such verification and that properly labeled buildings or building components of his manufacture will be accepted.

SECTION 16 SUSPENSION AND REVOCATION

The BBRS shall suspend or revoke, or cause to be suspended or revoked, the acceptance or certification or both of such reciprocally certified manufactured buildings or building components if the State Enforcement Agencies determine that the standards for the manufacture and inspection of which manufactured buildings or building components of such other state or other agency do not meet the objectives of the appropriate codes and these Rules and Regulations, or that such standards are not being enforced to the satisfaction of the State Enforcement Agencies. If such other state or other agency or its agents should suspend or revoke its approval and certification, the acceptance of certification or both granted under this Part shall be revoked or suspended accordingly. Notice to the State Enforcement Agencies, local enforcement agencies, manufacturer and to the Administrative Agency of such other state or agency of such suspension or revocation shall be in writing with the reasons for such suspension or revocations set forth therein. Appeals from such suspension or revocations shall receive timely review.

PART V APPEALS

SECTION 17 HEARINGS

All hearings shall comply with the applicable sections of the applicable codes and the Rules and Regulations thereof established for the purpose of appeal.

PART VI SCHEDULE OF FEES

SECTION 18 ESTABLISHMENT

The following is the SCHEDULE OF FEES established by the Commonwealth of Massachusetts for certifying manufactured buildings or building components. Fees shall be made payable to the "Commonwealth of Massachusetts Board of Building Regulations and Standards" and shall accompany all applications for certification.

18.1 COMPLIANCE ASSURANCE PROGRAMS AND BUILDING SYSTEMS

- a) An initial fee of twelve hundred (\$1200.00) dollars shall be charged each manufacturer for its certified compliance assurance program for each plant desiring certification. The maximum fee charged under this section shall be twelve hundred (\$1200.00) dollars for each manufacturing plant.

18.2 THIRD PARTY INSPECTION AGENCIES

- a) An initial fee of five hundred (\$500.00) dollars shall be charged to each third party inspection agency.

18.3 ANNUAL RENEWAL FEES

- a) One year from the date of certification of the manufacturer and every year thereafter certification is in effect, there shall be paid an annual renewal fee of six hundred and fifty (\$650.00) dollars for each such certification.
- b) One year from the date of certification of the Third Party Inspection Agency, and every year thereafter certification is in effect, there shall be paid an annual renewal fee of five hundred (\$500.00) dollars.

18.4 LABELS

- a) A fee of fifty dollars (\$50.00) per unit of a manufactured building shall be charged for each label issued by the BBRS.

Note: A "unit" as used in this section shall mean any building or proportion thereof which is towed or shipped separately to be somehow tied together at the site.

- b) A fee of one (\$1.00) dollar per building component shall be charged for each label issued by the BBRS for building components.

Note: Manufacturers of building components shall be permitted to use any labels as approved by the BBRS. If such labels are supplied by any source other than the BBRS, there shall be no charge for such labels.

- c) Mutilated labels may be replaced at the option of the BBRS at a cost of two (\$2.00) dollars each.
- d) Upon satisfactory proof to the BBRS of lost or stolen labels, not the result of negligence, labels may be replaced at a cost of two (\$2.00) dollars each.
- e) Labels shall be purchased from the BBRS by the inspection agency or manufacturer.

780-CMR-4

USE OF NATIVE LUMBER RULES AND REGULATIONS

FOREWORD

Contained herein are the RULES and REGULATIONS for Use of Native Lumber of the Massachusetts Board of Building Regulations and Standards, hereinafter known as the BBRS. In accordance with MGL C143, the BBRS is authorized to adopt rules and regulations which govern how authorized programs are administered.

These Rules and Regulations were formerly in Appendix Q in the Fourth Edition of the Massachusetts State Building Code. For Fifth Edition, they were made a separate document to reduce the size of the basic code, as well as to make them more readily available to interested parties.

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USE OF NATIVE LUMBER

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**USE OF NATIVE LUMBER
RULES AND REGULATIONS
780-CMR-4**

**SECTION I
ADMINISTRATION**

1.1 TITLE

As authorized by MGL C143, and in accordance with Section 128 of the State Building Code establishing the Construction Materials Safety Board, the following Rules and Regulations are adopted for Controlling the Use of Native Lumber.

1.2 DEFINITIONS

Unless otherwise expressly stated in the State Building Code, the following terms shall, for the purpose of these Rules and Regulations, have the meaning indicated in this section:

BBRS: State Board of Building Regulations and Standards

Board: Construction Materials Safety Board

Code: Commonwealth of Massachusetts State Building Code

Native Lumber: Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with the regulations of the BBRS. Such wood is ungraded but is stamped or certified in accordance with the requirements of Section 1701.1.2 the State Building Code. For the purpose this definition, native lumber shall be restricted to use in one-and two-story dwellings, barns, sheds, agricultural and accessory buildings and structures and other uses as permitted by Section 1701.1.2.

Person: Individual, partnership, corporation, trust, joint venture, etc.

Wood Producers: Persons or corporations in the business of milling wood into native lumber within the Commonwealth of Massachusetts.

1.3 REGISTRANTS

No person shall engage in the producing of native lumber for use in buildings or structures within the Commonwealth of Massachusetts unless registered by the BBRS.

1.4 APPLICATION FOR REGISTRATION

Each person desiring to obtain registration as a wood producer of native lumber shall make application to the BBRS upon such form and in such manner as the BBRS shall prescribe and shall furnish evidence satisfactory to the BBRS that he is qualified to be registered in accordance with these rules and regulations.

1.5 APPLICATION FEE

Applications shall be accompanied by a registration fee of fifty (\$50.00) dollars. This initial registration fee shall be for two (2) years. Registration shall be reviewed every two (2) years in accordance with the Rules and Regulations of the BBRS. The fee thereafter for a two (2) year renewal shall be twenty-five (\$25.00) dollars.

1.6 RENEWALS

Registration shall be valid for two (2) years and shall be renewed biennially. Within thirty (30) days before the expiration date of any such registration, the Administrator of the BBRS shall forward to each person so registered an application form for renewal. The said Administrator, upon receipt of the completed form and fee, shall renew the registration for a period of two (2) years or notify such applicant of his refusal with reasons thereof. Any application for renewal of registration which has expired shall require the payment of a new registration fee.

1.7 PRE-QUALIFYING AGENCY

The BBRS hereby designates the Massachusetts Wood Producers' Association as its pre-qualifying agency, providing, however, that the BBRS may revoke such designation at any time and may designate any other agency or agencies which it deems qualified, from time to time, to act as its pre-qualifying agency for pre-examination registration.

1.8 PENALTIES

Any such person who fails to comply with the requirements of these rules and regulations or who files a false report shall be subject to the penalties and actions as prescribed in Section 121 of the Code.

SECTION 2 REGISTRATION

2.1 STAMP

Each person registered by the BBRS shall be issued a name and number for use in stamping or certifying the native lumber which he produces.

2.2 STAMP CONTENTS

Each stamp filed with this BBRS shall be a minimum of two inches by four inches (2" x 4"), with a minimum of thirty-six (36) pt. letters and shall contain the following information:

- a) Name of native lumber producer;
- b) Registration number; and
- c) Species of wood.

2.3 STAMP USE

Each piece of native lumber produced shall bear the stamp so registered with the BBRS.

2.4 STAMP - UNLAWFUL USE

Each registered mill shall be assigned an individual number. It shall be unlawful to use such registration number in any mill other than the mill so registered.

2.5 STAMP - MANUFACTURE

Each producer shall be responsible for the manufacture and use of his stamp in accordance with the requirements of the BBRS and these Rules and Regulations.

SECTION 3 REVOCATION AND SUSPENSION PROCEDURES

3.1 REVOCATION AND SUSPENSION

The BBRS on its own initiative or upon the recommendation of the Construction Materials Safety Board may suspend or revoke the registration of any such mill registered in accordance with these Rules and Regulations, the State Building Code

or the standards of good practice. Notice of suspension or revocation of such registration shall be in writing with the reasons for suspension or revocation clearly set forth therein, and served in accordance with Section 121.2.1 of the Basic Code.

3.2 NOTICE AND CONFERENCE

Prior to suspension or revocation of the registration of any such mill so registered, written notice of such intent shall be served by the Construction Materials Safety Board in accordance with Section 121.2.1 of the Basic Code. Within ten (10) calendar days of receipt of such notice, the affected mill may request a conference before a three (3) member panel designated by the Chairman of the Construction Materials Safety Board, who will hear facts and make their recommendations to the Construction Materials Safety Board.

3.3 EFFECT OF

Upon suspension or revocation of the registration of any such mill so registered, such mill shall immediately cease engaging in the stamping or certifying of native lumber. The filing of an appeal with the State Building Code Appeals Board shall stay such suspension or revocation subject to Section 126.3.2 of the Basic Code.

SECTION 4 APPEALS

4.1 BUILDING CODE APPEALS BOARD

Anyone aggrieved by the decision of the BBRS, the Construction Materials Safety Board, the Massachusetts Wood Producers' Association or others may appeal to the State Building Code Appeals Board in accordance with Section 126 of the Basic Code.

SECTION 5 QUALIFICATION

5.1 EVALUATION

Evaluation by the Pre-Qualifying Agency shall be required prior to registration of a mill subject to these Rules and Regulations. The Agency shall examine and evaluate the application of all mills and make its recommendations to the Construction Materials Safety Board. The Construction Materials Safety Board shall make its recommendations to the BBRS who shall act on the application of the mill so requesting registration.

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CONSTRUCTION SUPERVISORS RULES AND REGULATIONS

FOREWORD

Contained herein are the RULES and REGULATIONS FOR licensing of Construction Supervisors of the Massachusetts Board of Building Regulations and Standards, hereinafter known as the BBRS. In accordance with MGL C143, the BBRS is authorized to adopt rules and regulations which govern how authorized programs are administered.

These Rules and Regulations were formerly in Appendix Q in the Fourth Edition and prior editions of the Massachusetts State Building Code. For the Fifth Edition, they were made a separate document to reduce the size of the basic code, as well as to make them more readily available to interested parties.

This Section covers the licensing rules and regulations for construction supervisors as defined in Section 109.11 of the Massachusetts State Building Code.

CONSTRUCTION SUPERVISOR RULES AND REGULATIONS
780-CMR-5

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**RULES AND REGULATIONS FOR
LICENSING CONSTRUCTION SUPERVISORS
780-CMR-5**

These Rules and Regulations cover the licensing requirements as defined in Section 109.1.1 of the Massachusetts State Building Code.

**SECTION 1
GENERAL**

1.1 TITLE: As authorized by MGL C143, the BBRS herewith establishes the Rules and Regulations for Licensing Construction Supervisors.

1.2 DEFINITIONS: Unless otherwise expressly stated in the State Building Code, the following terms shall, for the purpose of these Rules and Regulations, have the meaning indicated in this section:

BBRS: State Board of Building Regulations and Standards

Board Of Examiners (Board): The Board(s) established by the Chairman of the BBRS to carry out the function of licensing construction supervisors.

Construction Supervisor: Any individual directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition involving the structural elements of buildings and structures. Such term shall also apply to persons supervising themselves.

Licensed Designee: Any individual designated by the license holder to be present, in the absence of said license holder, during any of the periods stated in Section 2.12. Such designee shall also hold a Construction Supervisor's License, but his name or license number need not be contained on the building permit application.

Registration: The approval by the BBRS of an application and related documents by one desirous of being licensed as a construction supervisor.

1.3 SCOPE:

A. These Rules and Regulations govern the testing and licensing of individuals who are found to possess the requisite qualifications to be registered as qualified to have charge or control of construction, reconstruction, alteration, repair, removal or demolition of buildings or structures.

B. Except for those structures governed by Construction Control as regulated by Section 127.0 of the Code, any individual directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition involving the structural elements of buildings and structures shall be licensed according to the Rules and Regulations.

1.4 ADMINISTRATION AND ENFORCEMENT: The BBRS shall administer and enforce the provisions of these Rules and Regulations. The BBRS or those designated by it, shall administer examinations, under these Rules and Regulations, of persons desirous of being registered as qualified to receive a license as a construction supervisor.

1.5 BOARD OF EXAMINERS: The Chairman of the BBRS shall appoint a Board of Examiners, hereafter referred to as the "Board", which shall consist of any three (3) members of the BBRS who shall serve for one (1) year or until their successors are appointed, whichever is later. The said Chairman shall appoint a Chairman of the Board who shall serve until his successor is appointed. The Chairman of the BBRS may establish and abolish as many Boards of Examiners as he feel appropriate from time to time.

1.6 The Board shall meet monthly and at such other times as the Chairman deems it necessary to carry out its function established herein by the BBRS.

1.7 BOARD OF SURVEY: The Chairman of the BBRS shall appoint a Board of Survey which shall consist of two (2) home builders and one (1) member of the BBRS or designee who shall serve for one (1) year or until their successors are appointed, whichever is later.

1.7.1 For the purpose of informal disposition of complaints, the BBRS shall establish nine (9) regions in the Commonwealth, each of which shall be served by three (3) members of the Board of Survey.

1.7.2 All decisions of the Board of Survey shall be forwarded to the Board for disposition.

1.8 CITIES AND TOWNS:

1.8.1 EXISTING LICENSED CONSTRUCTION SUPERVISORS: All individuals directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition involving structural elements of buildings or structures who are duly licensed and qualified on January 1, 1981 within any city or town shall be allowed to continue in such capacity under the Rules and Regulations established by such jurisdiction until December 31, 1981. Such duly licensed person shall only

be allowed to engage in such practice only within the city or town granting such licensing.

SECTION 2 REGISTRATION AND LICENSING

2.1 Experience: Each applicant for license must prove to the Board that he has had at least three (3) years of experience in building construction or design in the field in which he desires to be licensed, together with any technical knowledge the Board may require him to possess.

2.1.1 Any person meeting one of the following requisites shall be licensed by the Board without testing until July 1, 1982.

A. Files with the BBRS prior to July 1, 1982 an application and applicable documents including an affidavit on a form provided by the BBRS attesting to his meeting the following qualifications:

i. A registered professional architect or engineer; or

ii. A four-year undergraduate degree in a field related to building construction or design and has at least one (1) year, out of the past ten (10) years, of experience in the supervision of building construction or design; or

iii. At least three (3) years, out of the past ten years, of experience in the supervision of building construction or design and a general knowledge of the quality and strength of building materials; a general knowledge of the accepted requirements for building construction, fire prevention, light, ventilation and safe exits; and a general knowledge of other equipment and materials essential for safety, comfort and convenience of the occupants of a building or structure.

2.2 Examinations: Examinations shall be held only by appointment. All applicants must be on file at the office of the Board seven (7) days or earlier, prior to the date set for examination unless the Board shall otherwise determine.

2.3 License Approvals: A vote of two (2) members of the Board shall be required to grant a license.

2.4 Expiration: Licenses issued pursuant to these rules and regulations shall expire five years from the date of issuance which shall be noted on said license and may be renewed.

A renewal of an original license shall be for periods of two years and a renewal license shall expire two years from the date of issuance which shall be noted on said license and may be renewed.

A renewal license shall not be issued unless application therefore is made within four years of the date of expiration of the most recently issued license.

2.5 Fees: Any and all fees charged for examination, for license fees, or for licensed renewal fees shall be determined by the Commonwealth and enforced by the BBRS.

2.5.1 The BBRS shall grant a license at no fee to any building official who, as a condition of their employment requires such license; provided that such person meets the necessary qualifications for licensure and provided further, that such license shall be authorized for use only during the course of employment and shall be appropriately stamped to indicate as such.

2.6 PROCEDURE FOR OBTAINING A LICENSE:

2.6.1 Applications shall be submitted on forms supplied by the BBRS.

2.6.2 The applicable forms may be mailed or brought by the applicant to the BBRS at One Ashburton Place, Boston, Massachusetts, 02108. It shall be the responsibility of the applicant to assure that the required forms are received by the BBRS. All forms shall be accompanied by the required license fee.

2.6.3 The BBRS shall keep a record of the date the application and all pertinent documents are received.

2.6.4 Upon receipt of a fully completed application, an examination date shall be set and the applicant so notified.

2.7 False statements: Any false statement on the application or references shall be sufficient reason to refuse to issue a license, or to suspend or revoke a license if issued.

2.8 Cause for suspension or revocation: Any false statement on the application for license, or in answer to any subsequent request for information, shall be cause for suspension or revocation of license.

2.9 PROCEDURE FOR SUSPENSION AND/OR REVOCATION OF LICENSE:

2.9.1 Upon receipt of a written complaint from a building official, or upon written complaint from other persons, or upon complaint of the Board itself, the Board of Survey in its discretion shall determine whether or not a hearing shall be held. It shall not be considered as a complaint if such work was performed prior to his/her being licensed or prior to January 1, 1982, whichever is later.

2.9.1.1 Only work related to a specific building permit shall be the basis of such complaint. Any work requiring a building permit which is performed without such permit shall be considered cause for suspension or revocation.

2.9.2 If the Board of Survey shall so determine that a hearing shall be held, it shall give at least seven (7) days notice to the complainant and license holder in accordance with Section 121.2.1 of the Code. The sending of notice to the address recorded on the records of the BBRS shall be deemed sufficient notice to the license holder.

2.9.3 The notice of hearing shall contain:

- a. The name of the complainant.
- b. A copy of the complaint.
- c. The complete file is available for inspection at the Office of the BBRS during its regular hours.
- d. The date, time and place of said hearing.
- e. Anyone may be represented by legal counsel.
- f. The license holder may present oral and written evidence to refute or mitigate any charge contained in the complaint and present witnesses in his behalf.

2.9.4 The Board of Survey in its discretion may continue the date for hearing upon request by the license holder or complainant or the Board of Survey.

2.9.5 The Board of Survey shall make a decision within ten (10) days after the hearing.

2.9.6 A vote of at least two (2) members of the Board of Survey is required to make a decision.

2.9.7 This decision shall be forwarded to the Board who shall hold a hearing and vote on all recommendations of the Board of Survey by accepting, rejecting, or modifying such decision.

2.9.7.1 The Board shall hold a hearing, and shall give at least seven (7) days notice to the complainant and license holder in accordance with Section 121.2.1 of the Code. The sending of notice to the address recorded on the records of the BBRS shall be deemed sufficient notice to the license holder.

2.9.7.2 The notice of hearing shall contain:

- a. The name of the complainant.
- b. A copy of the complaint.
- c. The complete file is available for inspection at the Office of the BBRS during its regular hours.

STATE BOARD OF BUILDING REGULATIONS AND STANDARDS

- d. The date, time and place of said hearing.
- e. Anyone may be represented by legal counsel.
- f. The license holder may present oral and written evidence to refute or mitigate any charge contained in the complaint and present witnesses in his behalf.

2.9.7.3 The Board in its discretion may continue the date for hearing upon request by the license holder or complainant or the Board itself.

2.9.7.4 The Board shall make a decision within ten (10) days after the hearing.

2.9.7.5 A vote of at least two (2) members of the Board is required to make a decision pursuant to Section 2.3 of these Rules.

2.9.7.6 This decision shall be final and binding upon the license holder and the complainant.

2.9.8 If, after notice has been duly given, a licensee shall not attend a hearing, the Board may in its discretion immediately suspend/revoke said license or proceed with the hearing so scheduled and make decision on the evidence so presented, or continue the hearing to another date.

2.9.9 In the event that the Board votes to suspend or revoke said license pursuant to this hearing, the license holder upon notice of the decision shall immediately comply with the said orders. A refusal to comply shall automatically revoke the licensee's right to supervise construction.

2.9.9.1 Suspension by the Board shall be for a definite term.

2.9.9.2 Any licensee whose license has been revoked by the Board may reapply for a license in accordance with these Rules and Regulations only after seeking and receiving approval to reapply from the Board.

2.10 Appeal: Any person aggrieved by a decision of the Board may appeal such decision to the State Building Code Appeals Board in accordance with Section 126 of the Code. Such appeal shall stay all proceedings in accordance with Section 126.3.2 of the Code.

2.11 Change of address: The license holder shall have the responsibility of reporting any change of address and/or change of circumstance to the BBRS. The information on file at the BBRS shall be deemed accurate unless changed by the license holder.

2.12 On-site presence of licensee: A licensed individual or a licensed designee shall be present on the site at some point to approve construction, reconstruction, alterations, removal or demolition involving the following work:

- a. Excavation
- b. Foundation (pouring or other)
- c. Decking
- d. Rough framing
- e. Finished framing
- f. Chimneys
 - 1. Excavation/foundation
 - 2. At the top of the smoke chamber and support of the flue liner
 - 3. When erection of the chimney is completed.

2.13 Lost/stolen licenses: License holders are required to keep the license in their possession at any and all building sites. If said license is lost, stolen or mutilated, it shall be the responsibility of the license holder to notify the BBRS.

2.14 Requirement to show license: Any building official may require the license holder to produce the license at any time on a job site.

2.15 RESPONSIBILITY OF EACH LICENSE HOLDER:

2.15.1 The license holder shall be fully and completely responsible for all work for which he is supervising. He shall be responsible for seeing that all work is done pursuant to the State Building Code and the drawings as approved by the building official.

2.15.2 The license holder shall be responsible to supervise the construction, reconstruction, alteration, repair, removal or demolition involving the structural elements of buildings and structures only pursuant to the State Building Code and all other applicable Laws of the Commonwealth even though he, the license holder, is not the permit holder but only a subcontractor or contractor to the permit holder.

2.15.3 The license holder shall immediately notify the building official in writing of the discovery of any violations which are covered by the building permit.

2.15.4 Any licensee who shall willfully violate Subsections 2.15.1, 2.15.2 or 2.15.3 or any other Sections of these Rules and Regulations and any procedures, as amended, shall be subject to revocation or suspension of license by the Board.

2.16 Permit applications: All building permit applications shall contain the name, signature and license number of the construction supervisor who is to supervise those persons engaged in construction, reconstruction, alteration, repair, removal or demolition as regulated by Section 109.1.1 of the Code and these Rules and

Regulations in the event that such licensee is no longer supervising said persons, the work shall immediately cease until a successor license holder is substituted on the records of the building department.

2.17 Gender of terms: The term "he" as used in these Rules Regulations and Procedures shall include the pronoun "he" and/or "she."

SECTION 3 ADMINISTRATION

3.1 Identification: The BBRS shall issue a card including a photo I.D. card, or a certificate or other form of identification.

3.2 Register: The BBRS shall maintain a register which will be available to the public at the office of the BBRS containing all licenses issued by the BBRS.

3.3 Examination: The BBRS shall determine whether an examination shall be required, or shall be oral or written and shall determine the content of the examination, if applicable.

3.4 Licensee adherence to regulations: All persons licensed shall be subject to these regulations as well as other rules, regulations, and procedures promulgated by this BBRS.

3.5 Fee determination: The license fees, examination fees, renewal fees, and registration fees shall be determined by the Commonwealth and enforced by the BBRS.

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RULES AND REGULATIONS FOR REGISTRATION AND ENFORCEMENT OF HOME IMPROVEMENT CONTRACTOR PROGRAM

FORWARD

These regulations cover the registration of home improvement contractors and subcontractors and enforcement of the requirements of MGL c. 142A as they pertain to home improvement contractors and subcontractors. Other regulations applicable to the Home Improvement Contractor program include:

201 CMR 14.00 Operation of the arbitration program authorized by MGL c. 142A. Promulgated by the secretary of the Executive Office of Consumer Affairs and Business Regulations.

201 CMR 15.00 Operation of the guaranty fund. Promulgated by the secretary of the Executive Office of Consumer Affairs and Business Regulations.

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RULES AND REGULATIONS FOR REGISTRATION AND ENFORCEMENT OF HOME IMPROVEMENT CONTRACTOR PROGRAM 780CMR-6

SECTION 1 GENERAL PROVISIONS

1.1 Title

These regulations, entitled "Registration and Enforcement of the Home Improvement Contractor Program" are authorized and promulgated by the administrator of the State Board of Building Regulations and Standards under the authority of MGL c. 142A.

1.2 Definitions

Application: The form provided by the director which, along with other documentation and fee(s) that may be required, must be duly filed to become a registered home improvement contractor or subcontractor.

Advertisement: Any commercial message in any newspaper, magazine, leaflet, flyer, catalog, display space in the telephone book, on radio, television, public address system, or made in person, by letter or other printed material, or any interior or exterior sign or display, including on a vehicle, which is delivered or made available to an owner by a registrant in any manner whatsoever.

Applicant: Any person who files an application to become registered as a home improvement contractor or subcontractor.

BBRS: The State Board of Building Regulations and Standards

Certificate: The document provided to the registrant which lists the certificate number and other information required by the director.

Certificate number: See registration number.

Clear and Conspicuous: The material representation being disclosed is of 10 point type and is so presented as to be readily noticed and understood by a reasonable person. Language in the body of a contract is "conspicuous" if it is in larger or contrasting type or color, or underscored.

Contract: Unless specifically noted otherwise in the text, a written agreement between a home improvement contractor and an owner contained in one or more documents for the performance of certain residential contracting work, including all labor, material, goods and services set forth under said agreement for a total amount exceeding \$1,000.00.

Contractor: Any person who, through himself or others, undertakes, offers to undertake, purports to have the capacity to undertake, or submits a bid for construction work. (See "home improvement contractor")

Director: The administrator of the State Board of Building Regulations and Standards, an agency within the executive office of public safety, established by MGL c. 6A, s. 19.

Employee: For the purposes of these regulations in determining the number of employees of an applicant for registration, any individual engaged in construction related activities who, in the weekly pay period prior to the date of registration worked 20 or more hours for the registrant and for whom, the registrant withheld or was required to withhold federal or state income taxes and who, during the same pay period, was not otherwise paid or had such taxes withheld by any other registrant. Included would be all construction workers, supervisors, sales personnel, designers, estimators, active partners and officers of corporations.

Fund: The residential contractor's guaranty fund. See "guaranty fund".

Fund administrator: the administrator of the residential contractor's guaranty fund, appointed by the secretary of the Executive Office of Consumer Affairs and Business Regulation.

Guaranty fund: The residential contractor's guaranty fund. A fund out of which an owner, as defined herein, aggrieved by a registrant(s) may be paid part or all of their damages under rules and regulations promulgated by the secretary of the Executive Office of Consumer Affairs and Business Regulation.

Home improvement contractor: Any person who owns or operates a contracting business who, through himself or others, undertakes, purports to have the capacity to undertake, offers to undertake, or submits a bid for residential contracting work to an owner, as such work is defined in 780CMR-6 and MGL c. 142A, and such work for each project is in a total amount in excess of one thousand dollars, and is registered or required to be registered in accordance with MGL c. 142A and 780CMR-6.

Homeowner: See "owner".

Local consumer group: A local or regional agency which deals with the resolution of consumer problems and who is determined eligible by the attorney general under standards set by the attorney general in accordance with MGL c. 12, s. 11G.

Mortgage broker: Any person, who, for compensation or gain, or in the expectation of compensation or gain, directly or indirectly negotiates, places, assists in placement, finds or offers to negotiate, place, assist in placement of mortgage loans on residential property for others, or as otherwise defined in MGL c. 255E.

Mortgage lender: Any person engaged in the business of making mortgage loans, or issuing commitments to fund mortgage loans, or accepting applications or fees associated with the making of mortgage loans which are secured by a mortgage on residential property, or as otherwise defined in MGL c. 255E.

Mortgage loan: A loan to any person made primarily for personal, family, or household purposes, secured wholly or partially by a mortgage on a residential property, or as otherwise defined by MGL c. 255E.

Owner: Any homeowner of a building which is an existing building at the time of a contract that is owner occupied, containing at least one but not more than four dwelling units, or a tenant authorized by the homeowner thereof, who orders, contracts for, or purchases the services of a contractor or subcontractor. An owner occupying a condominium unit in a building containing no more than four dwelling units qualifies as an owner under this definition, provided the owner owns a total of not more than four condominium units. A condominium association does not qualify as an owner.

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Owner-occupied: The residential building of at least one but not more than four dwelling units and occupied by the owner as a primary residence.

Permit: For the purposes of these regulations, any construction-related permit, excluding any permits required by the owner which are not considered construction-related, such as zoning, environmental, historical commission, and the like.

Person: Any individual, partnership, corporation, society, trust, association, or any other legal entity.

Registrant: Any duly registered home improvement contractor or subcontractor.

Registration number: The number assigned to the applicant after he has been approved for registration by the director and the Board of Building Regulations and Standards.

Residential contracting: The reconstruction, alteration, renovation, repair, modernization, conversion, improvement, removal or demolition or the construction of an addition to any pre-existing owner-occupied building containing at least one but not more than four dwelling units, which building or portion thereof is used or designed to be used as a residence or dwelling unit, or to structures which are adjacent and accessory to such residence or building, including but not necessarily limited to: garages, sheds, cabanas, poolhouses, gazebos.

Salesperson: any person, other than a supplier of materials or a laborer, who solicits, offers, negotiates, executes, or otherwise endeavors to procure by any means whatsoever, directly or indirectly, a contract for residential contracting services from an owner on behalf of a home improvement contractor or subcontractor.

Secretary: The secretary of the Executive Office of Consumer Affairs and Business Regulations.

Subcontract: A contract, written or verbal, in any amount, between a home improvement contractor and a subcontractor or between two subcontractors for the performance of any part of the home improvement contractor's or subcontractor's contract.

Subcontractor: Any person, other than a supplier of only materials, who enters into a contract, written or verbal, with a home improvement contractor for the performance of any part of a home improvement contractor's contract with an owner for residential contracting, or who enters into a contract with any other subcontractor for the performance of any part of the subcontractor's contract.

1.3 Scope

1.3.1 MGL c. 142A and 780CMR-6 require the registration of persons who engage in residential contracting work as defined in 780CMR-6 and MGL c. 142A after July 1, 1992, and define the requirements of MGL c. 142A and enforcement of these requirements, as they pertain to home improvement contractors and subcontractors.

1.3.2 Except for those persons who are specifically exempt from the provisions of 780CMR-6 and MGL c. 142A, all contractors and subcontractors who engage in residential contracting as defined in 780CMR-6 and MGL c. 142A shall be subject to and shall comply with 780CMR-6 and MGL c. 142A.

1.4 Administration and Enforcement

1.4.1 Director responsibility: The director shall promulgate and enforce the provisions of 780CMR-6 and MGL c. 142A as to all home improvement contractors and subcontractors who are registered or required to register.

1.4.2 Advisory board: The director may appoint an advisory board which may review proposed suspensions, revocations, and administrative penalties against any registrants, and shall make recommendations to the director relative thereto. The advisory board shall include five (5) members, any three of whom will constitute a quorum; the fund administrator, a representative of the attorney general, a representative of a consumer group appointed by the secretary, a representative of the Massachusetts Homebuilders Association who is a registered home improvement contractor or subcontractor, and a BBRS staff member.

1.5 Persons Who Must Register

1.5.1 General: All home improvement contractors and subcontractors, as defined in 780CMR-6, except those exempt in 780CMR-6, s. 1.6, shall register with the director by filing an application prescribed by the director.

1.5.2 Designated individual: In the case of registration by a corporation or partnership, an individual shall be designated to be responsible for the corporation's or partnership's residential contracting work.

1.5.3 Liability: The corporation or partnership and its designee shall be jointly and severally liable for the payment of the registration fee, the payment to the guaranty fund, and for violations of any provisions of 780CMR-6, including actions by the registrant's employees, subcontractors or salespersons.

1.6 Persons Exempt From Registration or Renewal

Any person exempt from registration under 780 CMR-6, s. 1.6, and does not voluntarily register, is not subject to any of the provisions of 780CMR-6 or MGL c. 142A. Persons exempt from registration are:

1. the Commonwealth or its political subdivisions;
2. any school, public or private, offering as part of a vocational education program courses and training in any aspects of home construction or home improvements;
3. electricians, plumbers, architects or any other persons who are required by law to attain standards of competency or experience as a prerequisite to licensure for and engaging in such

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trade or profession and who are acting exclusively within the scope of the profession for which they are currently licensed pursuant to such law, construction supervisors excepted.

4. persons dealing in the sale of goods or materials who neither arrange to perform nor perform directly or indirectly any work or labor in connection with the installation of or application of the goods or materials;

5. any owner personally doing residential contracting work on his/her own home;

6. any individual who performs construction related labor or services for a home improvement contractor or subcontractor, for wages or salary and who does not act in the capacity of a home improvement contractor or subcontractor;

7. any contractor or subcontractor who works on one residential contracting undertaking or project by one or more contracts where the aggregate contract price to the owner is less than one thousand dollars; provided, however, that the contract is not in an amount of less than one thousand dollars for the purpose of evading 780CMR-6 or MGL c. 142A.

8. any person who engages in the business of a home improvement contractor or subcontractor on other than a full-time basis, and who has earned in gross revenues from residential contracting work, less than five thousand dollars in the previous twelve-month period;

9. any person acting as a home improvement contractor or subcontractor who was enrolled as a full-time student in a secondary school or college with degree granting authority from the government of the state in which the school is located, for the immediately preceding academic semester and is also enrolled as a full-time student for the next academic semester, in the same or a similar degree granting secondary school or college provided that at least two-thirds of the number of employees of the contractor or subcontractor are similarly enrolled in secondary schools or colleges and that the home improvement contractor or subcontractor does not reasonably expect to earn or does not in fact earn, in gross revenues, more than five thousand dollars from residential contracting work;

10. persons who install any or all of the following:

- central heating,
- air-conditioning systems,
- energy-conservation devices, or
- provides conservation services conducted by or on behalf of a public utility under a program approved by the department of public utilities;

11. any contractor or subcontractor who works exclusively in any of the following home improvement areas:

- landscaping;
- interior painting or wall covering;
- finished floor covering, including, but not limited to, carpeting, vinyl, tile, non-structural hardwood;
- fencing or freestanding masonry walls;
- above-ground swimming pools;
- shutter or awning installation;
- ground level patios; includes flagstone, concrete, block, and wood set directly onto the ground; excludes decks which are supported above ground.
- asphalt and driveway installation and maintenance.

**SECTION 2.
REGISTRATION PROCEDURE**

2.1 Applicant Actions

2.1.1 Application: Each applicant for registration as a home improvement contractor or subcontractor shall submit a completed copy of an application form supplied by the director and necessary supporting documents to the director, along with such fees as required by the provisions of 780CMR-6, s. 2.4, and MGL c. 142A.

2.1.2 Supporting documentation: Supporting documentation shall include, as applicable:

- 1. For corporations:** an official document which lists the names and addresses of officers, directors, and major stockholders such as: a copy of the articles of incorporation, a current annual report as filed with the Secretary of State, a copy of the registration as a foreign corporation filed with the Secretary of State, or any other documentation which lists the names and addresses of officers, directors, and major stockholders, will be accepted in lieu of listing these names on the application.
- 2. For partnerships:** either a copy of the current partnership agreement containing the requested information, or listing of the names and addresses of all partners on the application form.
- 3. For all non-corporate applicants:** a copy of the business registration certificate filed with a city or town pursuant to MGL c. 110, s. 5, if applicable.

2.1.3 Mailing address: The application, supporting documentation and fees may be mailed or delivered as follows:

Director
Home Improvement Contractor Registration
One Ashburton Place, Room 1301
Boston, MA 02108

It shall be the responsibility of the applicant to assure that the required registration material is received by the director.

2.1.4 Certified check/money order: All applications shall be accompanied by the registration fee or by evidence of exemption, and by the fee for the guaranty fund. Fees shall be in the form of a money order or certified check. Two money orders or certified checks shall be included - one for the registration fee, if required, and one for the guaranty fund. Make checks or money orders payable to the Commonwealth of Massachusetts.

As noted in s. 2.4.1.2, licensed individual construction supervisors and individual motor vehicle repair shops who desire to register are exempt from the registration fee only; there are no exemptions to the requirement for a contribution to the guaranty fund.

2.1.5 Lost/destroyed certificate of registration: Upon receipt of a nominal fee as established by the Commonwealth, and a completed affidavit provided by the director, that a certificate of registration has been lost or destroyed, a replacement certificate clearly identified as such, shall be issued by the director.

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2.1.6 Licensee liabilities: The provisions of 780CMR-6 and those of MGL c. 142A shall not be construed to relieve or lessen the responsibility of any person registered under 780CMR-6 and MGL c. 142A or licensed under MGL c. 143 s. 94(i), nor shall the Commonwealth be deemed to have assumed any such liability by reason of the issuance of registration or licensure.

2.2 Director's Action on Application

2.2.1 Issuance of certificate: Upon receipt of a completed application form, supporting documentation, and the proper fee(s) therefor, the director shall:

- ascertain whether such applicant meets all of the registration requirements and there are no grounds for rejection as specified in 780CMR-6, s. 2.2.2;
- if all requirements are met, the Director, within thirty days of receipt of the application shall assign a registration number, with the approval of the BBRs;
- prepare and send by first class mail to such applicant, at the address stated on the registration form, a certificate indicating the applicant's registration number, name, address, name of the entity of the applicant, and such other information as is deemed necessary by the director. The registration certificate is not transferable to any other person.

2.2.2 Grounds for refusal to register or renew: No application for registration or renewal conforming to 780CMR-6 and MGL c. 142A may be denied except for a finding by the director that the applicant has done one or more of the following acts which are grounds for denial after the effective date of 780CMR-6:

1. made material omissions or misrepresentations of fact on the home improvement contractor or subcontractor application for registration or renewal and supporting documentation or on an application for licensure or renewal under MGL c. 143, s. 94(i). (construction supervisor license);
2. failed to pay either the registration fee or the payment to the fund as required under 780CMR-6, s. 2.4.
3. failed consistently to perform contracts or has performed said contracts in an unworkmanlike manner or has failed to complete said contracts with no good cause or has engaged in fraud or bad faith with respect to said contracts;
4. failed to meet or has violated any of the requirements for registered home improvement contractors or subcontractors as defined in 780CMR-6, or has performed or is attempting to perform any act prohibited by 780CMR-6 and MGL c. 142A.
5. is under suspension or revocation of registration as a home improvement contractor or subcontractor;
6. has failed to repay the guaranty fund for any payments made by the fund on the registrant's account.

2.2.3 Application refused: If the application is refused, the director shall, within thirty days of the application, notify the applicant in writing by first class mail of the reasons for the rejection.

2.2.3.1 If applicable, the applicant may correct the deficiencies in the application material and return the corrected data to the director within ten days of the date of mailing of the director's notice of refusal, who will then assign a registration number and issue a certificate.

2.2.3.2 If the grounds for rejection are based upon substantive grounds for refusal of 780CMR-6, s. 2.2.2, and MGL 142A, the applicant may request that the director reconsider the application as submitted by stating his/her reasons therefore, in writing, within ten days of the date of mailing of the notice of the director's rejection of the application.

2.2.4 Record retention: The director shall keep a record of the date the application and all pertinent documents are received. In addition, the director shall keep on file, in convenient form and open to public inspection, all applications for registration, copies of certificates issued, and the names of all home improvement contractors or subcontractors whose registration has been revoked, suspended or surrendered.

2.3 Duration of Registration

2.3.1 Initial registration: Each such registration shall be in effect for two years from the date of issuance, unless suspended or revoked prior to that time, as provided in 780CMR-6 and MGL c. 142A.

2.3.2 Renewal of registration: Not less than 90 days before the date of the expiration of such registration, the director shall send or cause to be sent, to each registered contractor or subcontractor, at the address on record, a notice for renewal of the registration and a copy of all forms necessary for such renewal, by first class mail, along with a schedule of such fees as are necessary for said renewal. Renewals will remain in effect for two years from date of renewal if not suspended or revoked prior to that time. The responsibility for timely renewal of registration remains with the registrant, notwithstanding this notice.

2.4 Fees to be Paid Upon Registration or Renewal

2.4.1 Registration and renewal fee: All home improvement contractors and subcontractors, except those that are exempt from the registration or renewal fee in 780CMR-6, s. 2.4.1.2, shall, at the time of registration or renewal, pay to the Commonwealth, a fee in the amount of the fee then being charged for the construction supervisor's license under MGL c. 143 s. 94(i).

2.4.1.2 Exemptions from registration and renewal fee:

(1) Every individual construction supervisor licensed by the BBRS in accordance with MGL c. 143, s. 94(i), and every individual motor vehicle repair shop registered in accordance with MGL c. 100A, s. 2, who desires to be registered or renew their registration as a home improvement contractor or subcontractor, and whose license or registration fee has been paid and is current, shall be deemed to have paid the registration fee required by 780CMR-6, s. 2.4.1.

(2) If the applicant is a corporation or partnership and the named individual responsible for home improvement contracting work is a licensed construction supervisor and a substantial owner (10% or more of ownership), the applicant entity is exempt from the registration and renewal fee.

2.4.2 Contribution to guaranty fund - initial registration: At the time of initial registration, contractors and subcontractors shall also pay to the Commonwealth, in a separate certified check or money order from the above stated registration fee, if any, a fee payable to the guaranty fund.

2.4.2.1 The fee paid by contractors and subcontractors to the guaranty fund shall be determined based on the number of employees (active construction-related personnel) of the home improvement contractor or subcontractor, as defined in 780CMR-6, s. 1.2, on the date of initial registration, as follows:

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1. Zero to 3 employees	\$100.00
2. 4 employees up to and including 10	\$200.00
3. 11 employees up to and including 30	\$300.00
4. More than 30 employees	\$500.00

2.4.2.2 The fee to the guaranty fund shall be paid by every registered home improvement contractor and subcontractor regardless of whether such registrant is exempt from paying the registration fee because of the home improvement contractor or subcontractor's status as a licensed construction supervisor or registered motor vehicle repair shop owner.

2.4.2.3 Any registrant who fails to accurately determine the number of employees and pay the correct fee therefor shall be deemed to have failed to pay the fees required for registration and shall be subject to enforcement action by the director, in accordance with 780CMR-6, ss. 2.2.2, 4.1 and 4.3.

2.4.2.4 No home improvement contractor or subcontractor shall be required to pay the contribution to the guaranty fund more than once unless the fund administrator determines that the amount of the fund is insufficient to maintain it at a level commensurate with claims made against the fund. If such a determination is so made, after conducting a public hearing, the director, in consultation with the fund administrator, may assess each registered home improvement contractor or subcontractor an appropriate fee, the amount to be determined by the commissioner of administration and finance, which shall not exceed the amount of the original assessment; provided, however, that the director shall not assess any registrant more than once in any twelve month period.

2.5 Responsibilities of Each Registrant

2.5.1 Changes in status: Each registrant shall be responsible for reporting, in writing, within thirty days, changes in trade name or address or additions of business name(s), and any other pertinent changes in circumstances to the director.

2.5.2 Display of certificate number: Every contract, building permit and advertisement for residential contracting as defined in 780CMR-6 shall display the home improvement contractor's or subcontractor's certificate of registration number.

2.5.3 Return of certificate: Upon the expiration, termination or voluntary surrender of a registration, the registrant shall deliver the certificate to the director who shall cancel the registration and endorse the date of expiration, termination or surrender. In such case, no further residential contracting work will be engaged in by the contractor or subcontractor.

SECTION 3 ENFORCEMENT PROCEDURES

3.1 Notification of Violation

The fund administrator shall notify the director if a registrant fails to repay the fund for any payment made from the fund to an owner because of the conduct of said registrant. In addition, the secretary, attorney general, district attorney, or local consumer groups as defined in 780CMR-6 s. 1.2, shall advise the director of orders resulting from arbitration or court action, or other significant complaint activity against individual registrants, accompanied by a recommendation for enforcement action against a registrant. Significant complaint activity shall include but not necessarily be limited to:

1. repeated acts prohibited under 780CMR-6, s. 4.4;

2. a flagrant complaint or complaints involving substantial harm to an owner or owners.

Nothing in 780CMR-6, s. 3.1 shall preclude the director from initiating enforcement action on his own initiative.

3.2 Consideration of Factors

The director, upon receipt of the notification under 780CMR-6 s. 3.1 shall consider the pertinent factors in the particular situation, and decide what enforcement action in accordance with 780CMR-6, s. 4, if any, shall be taken against the registrant considering, among any other pertinent factors, the recommendations of the secretary, attorney general, district attorney, and/or the local consumer group(s), the severity of the violation(s), the frequency of repetitive violations, the harm to the complainant or the general public, and the impact upon the registrant.

3.3 Letter of Reprimand

The director, on his own initiative, may send a letter of reprimand to the registrant containing the facts of the situation, which may include that the incident has been noted on the registrant's official records, and the possibility of more severe disciplinary action in the event of repetitive violations.

3.4 Suspension, Revocation, Administrative Penalty

The director may institute a suspension or revocation of registrant's certificate of registration, or administrative penalty against a registrant, subject to the following hearing provisions:

3.4.1 Hearing procedure

3.4.1.1 Notice of hearing

1. The director shall give at least fourteen (14) days' notice of a scheduled hearing to the registrant, and all parties to the hearing i.e., the secretary, the attorney general, the district attorney, and/or the local consumer group from whom the recommendation for enforcement action was received. Notice to the registrant will be deemed sufficient if it is mailed to the most recent address of record in the director's file.

2. The notice of hearing shall contain, at minimum:

- a. The nature of the violation;
- b. A statement of the enforcement action recommendation;
- c. The date, time and place for the hearing;
- d. Notice that the registrant may be represented by legal counsel;
- e. Advise that the complete investigation file is available for review at the office of the director during regular business hours;
- f. Notice that the registrant may present written and oral testimony and evidence to mitigate any planned enforcement action.

3. The hearing will be conducted by the director or a hearings officer appointed by the director.

3.4.1.2 Rescheduling of hearing: The director, at his discretion, may delay and reschedule the date for such hearing upon written request of the registrant, the secretary, the attorney general, a district attorney, or the involved local consumer group, provided the request is received not less than seven (7) days prior to such hearing.

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3.4.1.3 Decision: Following the close of the hearing, the director shall issue a written decision on the violation within fourteen (14) working days. A copy of the decision shall be sent to the registrant, the secretary, the attorney general, the involved district attorney and local consumer group.

3.4.1.4 Appeal: Any party to the hearing who is aggrieved by the decision may appeal under the applicable provisions of the Massachusetts Administrative Procedures Act, MGL c. 30A.

3.5. Injunctions, Restitution

The director, on his own initiative, may institute court action in accordance with 780CMR-6, s. 4.3, to obtain a permanent or temporary injunction or an order requiring restitution or completion of a home improvement contractor's contract with an owner.

3.6 Fines and Criminal Penalties

The attorney general or a district attorney may initiate court action on his own initiative in accordance with 780CMR-6, s. 4.2.

Section 4 ENFORCEMENT ACTIONS

4.1 Administrative Penalties

If the director determines that any registrant is liable for a violation of any of the provisions of 780CMR-6 or MGL c. 142A, the director may institute one or more of the following actions:

4.1.1 Allowable actions

1. suspend the registrant's certificate of registration for such period of time as shall be determined by the director;
2. revoke the registrant's certificate of registration;
3. send a letter of reprimand to the registrant;
4. assess an administrative penalty not to exceed two thousand dollars, payable within thirty days of the date of the order of assessment, for each violation of any provisions of 780CMR-6 and MGL c. 142A committed by the home improvement contractor(s) or subcontractor(s) who are registered or required to be registered under this chapter. This penalty shall be deposited to the fund.

4.1.2 Pendency of a claim: The pendency of a claim against the fund shall not limit the director from taking enforcement action against any registrant pursuant to 780CMR-6 or MGL c. 142A.

4.2 Fines and Criminal Penalties

4.2.1 Sought by attorney general or district attorney: Fines and imprisonment specified in 780CMR-6 and MGL c. 142A may be sought by the attorney general or a district attorney, and such fines and imprisonment shall be in addition to any administrative penalty otherwise applicable thereto.

4.2.2 Operating without a certificate: Any home improvement contractor or subcontractor who shall knowingly, willfully, or negligently operate without obtaining a certificate of registration as required by 780CMR-6 and MGL c. 142A and who is not otherwise exempt from the registration

requirements or any home improvement contractor or subcontractor who continues to operate after revocation of or during suspension of, or who had failed to renew his certificate of registration, shall be punished by a fine not exceeding five thousand dollars or imprisonment not exceeding two years or both.

4.2.3 Other violations: Any person who knowingly and willfully violates any of the provisions of 780CMR-6 or MGL c. 142A, with respect to which a greater penalty is not otherwise provided by the provisions of 780CMR-6 or MGL c. 142A or by any other law may be punished by a fine of not more than two thousand dollars or by imprisonment for not more than one year or both.

4.3 Injunctions, Restitution

4.3.1 Order from superior court: If the director concludes that the continuing conduct of any person alleged to be in violation of 780CMR-6 and MGL c. 142A may result in substantial or irreparable harm to any citizen of the Commonwealth, the director may seek:

1. a permanent or temporary injunction with respect to the conduct from the superior court of any county in which the alleged violation is occurring, or in which the violator has its principal place of business; or
2. an order requiring restitution or satisfactory completion of the home improvement contractor's contract with an owner.

4.3.2 Bond not required: The director shall not be required to file a bond or to show a lack of an adequate remedy at law when seeking an injunction under MGL c. 142A against any person, association, partnership, or corporation not registered under 780CMR-6 and MGL c. 142A.

4.4 Permit Requirements, Prohibited Acts and Penalties

4.4.1 Permit requirements: All building permits for residential contracting work covered by 780CMR-6 and MGL c. 142A shall:

- (1) clearly state that persons contracting with unregistered contractors do not have access to the guaranty fund;
- (2) contain the registered home improvement contractor's or subcontractor's certificate number.

4.4.2 Prohibited acts: The following acts are prohibited by registered home improvement contractors or subcontractors, and those required to register under the provisions of 780CMR-6 and MGL c. 142A:

- (1) operating without a certificate of registration issued by the director;
- (2) abandoning or failing to perform, without justification, any contract or project engaged in or undertaken, or deviating from or disregarding plans or specifications in any material way without the consent of the owner, except for changes in plans, specifications, or construction techniques required by building regulations;
- (3) failing to credit the owner any payment they have made to the contractor or his salesperson in connection with a residential contracting transaction;

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- (4) making any material misrepresentation in the procurement of a contract or making any false promise of a character likely to influence, persuade or induce the procurement of contract;
- (5) acting directly, regardless of the receipt or expectation of receipt of compensation or gain from the mortgage lender, in connection with a residential contracting transaction by preparing, offering or negotiating or attempting to or agreeing to prepare, arrange, offer or negotiate a mortgage loan on behalf of a mortgage lender;
- (6) acting as a mortgage broker or agent for any mortgage lender;
- (7) publishing, directly or indirectly, any advertisement relating to residential contracting which does not contain the home improvement contractor's or subcontractor's certificate of registration number or which does contain an assertion, representation or statement of fact which is false, deceptive, or misleading;
- (8) advertising in any manner that a registrant is registered under this chapter unless the advertisement includes an accurate reference to the home improvement contractor's or subcontractor's certificate of registration;
- (9) violating any of the building laws of the Commonwealth or of any political subdivision thereof;
- (10) misrepresenting a material fact by an applicant in obtaining a certificate of registration;
- (11) failing to notify the director of any change of trade name or address as required by 780CMR-6, s. 2.5.1;
- (12) conducting a residential contracting business in any name other than the one in which the home improvement contractor or subcontractor is registered;
- (13) failing to pay for materials or services rendered in connection with his/her operating as a home improvement contractor or subcontractor where he/she has received sufficient funds as payment for the particular construction work, project or operation for which the services or materials were rendered or purchased;
- (14) failing to comply with any order, demand or requirement lawfully made by the director or fund administrator under and within the authority of 780CMR-6 and MGL 142A;
- (15) demanding or receiving payment in violation of 780CMR-6, ss. 5.2.1 (5),(6), or 5.2.2;
- (16) violating any other provisions of 780CMR-6 and MGL c. 142A.
- (17) failing to pay to the guaranty fund in full, including interest, any amount paid from said fund because of the conduct of the registrant.
- (18) any of the grounds for refusal to register or renew in 780CMR, s. 2.2.2 are also considered prohibited acts.
- (19) failing, within 21 days, to comply with, or advise the owner of intent to comply with, or appeal the decision of, an arbitrator as provided for in MGL 142A and 201CMR14:00.
- (20) failing to display the registration number on every contract, building permit and advertisement as required by 780CMR-6, ss. 5.2.1(2), 4.4.1(2), 4.4.2(7), and 4.4.2(8).

4.4.3 Penalties: Violations of 780CMR-6 or MGL c. 142A shall subject the violator to the administrative sanctions of 780CMR-6, s. 4.1 and to criminal prosecution or other court action as prescribed in 780CMR-6, ss. 4.2 and 4.3.

4.4.4 Deceptive act: Violations of any of the provisions of 780CMR-6 and MGL c. 142A shall constitute an unfair or deceptive act under the provisions of MGL c. 93A.

SECTION 5 CONTRACTS

5.1 Contract In Writing

Every agreement between a home improvement contractor and an owner to perform residential contracting services in an amount in excess of one thousand dollars shall be in writing.

5.2 Contents of Contract

5.2.1 Documents and information: Every agreement to perform residential contracting services in excess of one thousand dollars shall include, but not be limited to, the following documents and information:

- (1) the complete agreement between the owner and the contractor and a clear description of any other documents which are or shall be incorporated into said agreement;
- (2) the full names, federal ID number, if applicable, addresses (exclusive of post office box addresses), registration number of the home improvement contractor, the name(s) of the salesperson(s), if any, who solicited or negotiated the contract and the date when said contract was executed by the parties;
- (3) the date on which the work under the contract is scheduled to begin and the date on which said work is scheduled to be substantially completed;
- (4) a detailed description of the work to be done and the materials to be used;
- (5) the total amount agreed to be paid for the work to be performed under the contract;
- (6) a time schedule of payments to be made under said contract and the amount of each payment stated in dollars, including all finance charges, if any. Any deposit required under the contract to be paid in advance of the commencement of work under said contract shall not exceed the greater of one-third of the total contract price or the actual cost of any material or equipment of a special order or custom made nature, which must be ordered in advance of the commencement of the work, in order to assure that the project will proceed on schedule. No final payment shall be demanded until the contract is completed to the satisfaction of the parties thereto;
- (7) the signature of all parties shall be affixed to the contract;
- (8) there shall be a clear and conspicuous notice appearing in the contract stating:

HOME IMPROVEMENT PROGRAM

a. that all home improvement contractors and subcontractors shall be registered by the director and that any inquiries about a contractor or subcontractor relating to a registration should be directed to:

Director
Home Improvement Contractor Registration
One Ashburton Place, Room 1301
Boston, MA 02108
(617) 727-8598

b. the registration number of the home improvement contractor on the first page of the contract.

c. the owner's three-day cancellation rights under MGL c. 93, s. 48; MGL c. 140D, s. 10 or MGL c. 255D s. 14, as may be applicable.

d. all warranties and the owner's rights under the provisions of 780CMR-6 and MGL c. 142A;

e. in ten point bold type or larger, directly above the space provided for the signature, the following statement:

DO NOT SIGN THIS CONTRACT IF THERE ARE ANY BLANK SPACES

f. whether any lien or security interest is on the residence as a consequence of the contract;

(9) an enumeration of such other matters upon which the owner and the contractor may lawfully agree; provided, however that no such agreement may waive any rights conveyed to the owner under the provisions of 780CMR-6 and MGL c. 142A;

(10) any other provision otherwise required by the applicable laws of the Commonwealth.

5.2.2 Permit notice: Any contract entered into between a home improvement contractor and an owner shall contain a clause informing the owner of the following:

1. any and all necessary construction-related permits;
2. that it shall be the obligation of the home improvement contractor to obtain such permits as the owner's agent;
3. that owners who secure their own construction-related permits or deal with unregistered contractors will be excluded from the guaranty fund provisions of MGL c. 142A;

5.2.3 Acceleration of payment: No contract shall contain an acceleration clause under which any part or all of the balance not yet due may be declared due and payable because the holder deems himself to be insecure. However, where the contractor deems himself to be insecure he/she may require as a prerequisite to continuing said work that the balance of funds due under the contract, which are in the possession of the owner, shall be placed in a joint escrow account requiring the signatures of the home improvement contractor and owner for withdrawal.

5.2.4 Copy to owner: At the time of signing, the owner shall be furnished with a copy of the contract signed by both the home improvement contractor and the owner. No work shall begin prior to the signing of the contract and transmittal to the owner of a copy of such contract.

5.2.5 Arbitration: Any contract entered into between a home improvement contractor and owner may provide that the home improvement contractor may initiate alternative dispute resolution through any private arbitration services approved by the secretary, as provided in MGL c. 142A; provided, that said alternative dispute resolution provision is clearly and conspicuously disclosed in the contract, in language designated by the secretary, and that each party separately signs and dates the provision, thereby assenting to the procedure. The following language and format is acceptable:

THE CONTRACTOR AND THE HOMEOWNER HEREBY MUTUALLY AGREE IN ADVANCE THAT IN THE EVENT THE CONTRACTOR HAS A DISPUTE CONCERNING THIS CONTRACT, THE CONTRACTOR MAY SUBMIT SUCH DISPUTE TO A PRIVATE ARBITRATION SERVICE WHICH HAS BEEN APPROVED BY THE SECRETARY OF THE EXECUTIVE OFFICE OF CONSUMER AFFAIRS AND BUSINESS REGULATIONS AND THE CONSUMER SHALL BE REQUIRED TO SUBMIT TO SUCH ARBITRATION AS PROVIDED IN MGL c.142A.

Contractor

Owner

NOTICE: THE SIGNATURES OF THE PARTIES ABOVE APPLY ONLY TO THE AGREEMENT OF THE PARTIES TO ALTERNATIVE DISPUTE SETTLEMENT INITIATED BY THE CONTRACTOR. THE OWNER MAY INITIATE ALTERNATIVE DISPUTE RESOLUTION EVEN WHERE THIS SECTION IS NOT SEPARATELY SIGNED BY THE PARTIES.

5.3 Dispute Resolution

5.3.1 Court action: Any party may bring an action to enforce any provisions of 780CMR-6 and MGL c. 142A, in superior court, the district court, or the small claims division of the district court.

5.3.2 Owner right to arbitration: In the alternative, an owner may request that a dispute resulting from and relating to residential contracting be decided under the terms of a private arbitration service approved by the secretary.

5.3.3 Contractor right to arbitration: The home improvement contractor may initiate dispute resolution through private arbitration services approved by the secretary, provided: that the contract between the owner and the home improvement contractor contains such a clause as provided in 780CMR-6, s. 5.2.5.

5.4 Validity of contract: Contracts which fail to comply with the requirements of 780CMR-6 and MGL c. 142A shall not be invalid solely because of noncompliance.

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